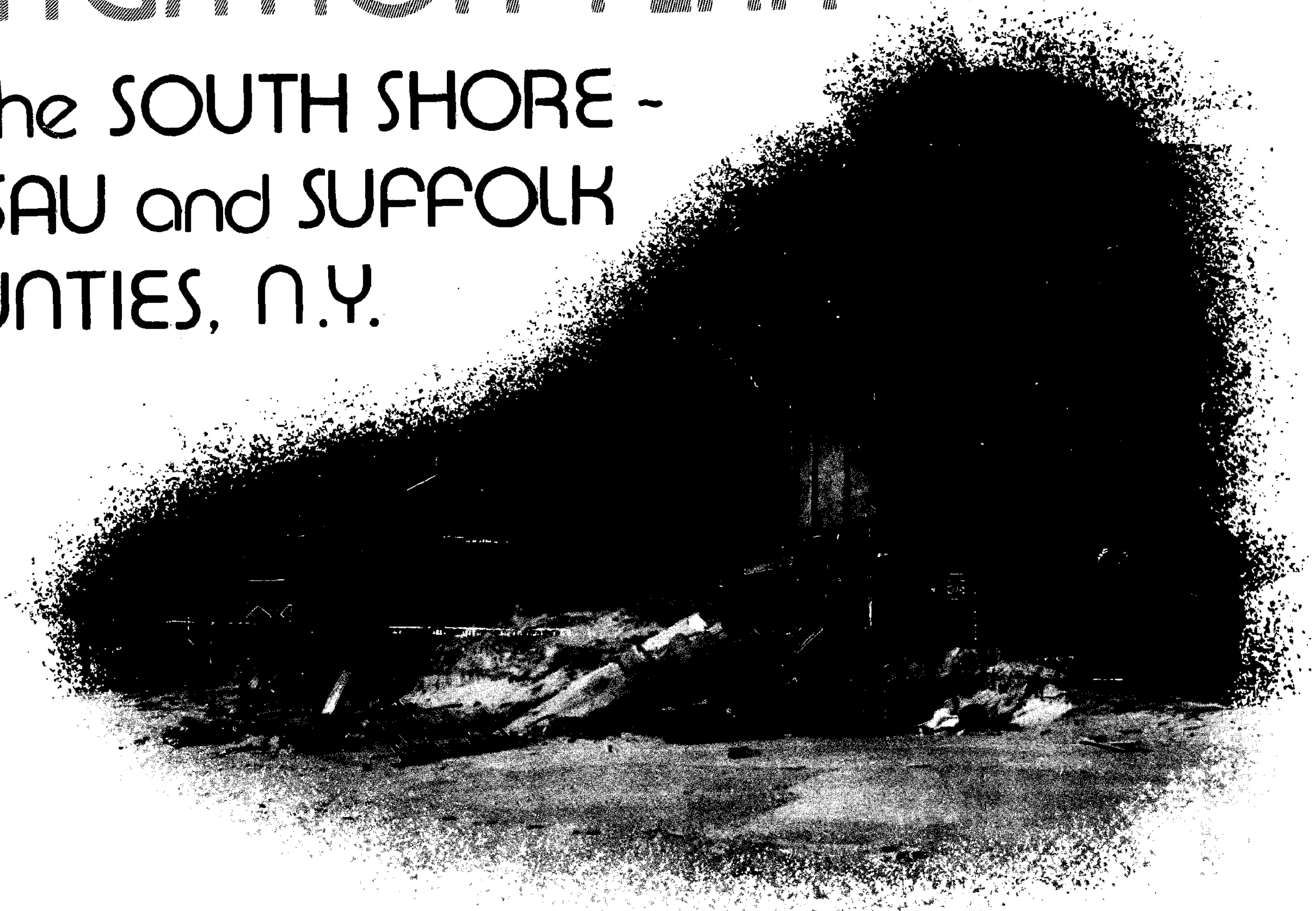
HURRICANE DAMAGE MITIGATION PLAN

for the SOUTH SHORE - NASSAU and SUFFOLK COUNTIES, N.Y.



Long Island Regional Planning Board

HURRICANE DAMAGE MITIGATION PLAN
FOR THE SOUTH SHORE OF
NASSAU AND SUFFOLK COUNTIES
NEW YORK

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October 1984

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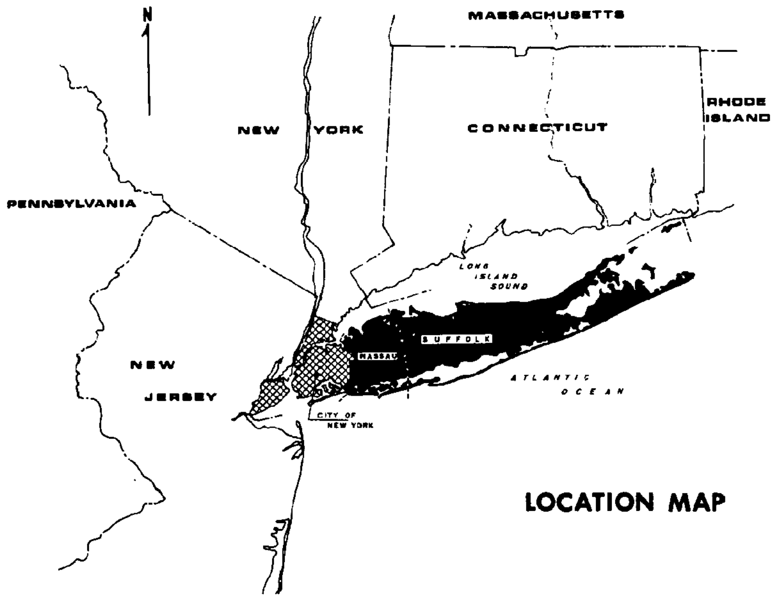


KEY TO MUNICIPALITIES IN NASSAU AND SUFFOLK COUNTIES

VILLAGES IN NASSAU COUNTY

Town of Hempstead

1. Atlantic Beach
2. Bellerose
3. Cedarhurst
4. East Rockaway
* 5. Floral Park (North Hempstead)
6. Freeport
7. Garden City
8. Hempstead
9. Hewlett Bay Park
10. Hewlett Harbor
11. Hewlett Neck
12. Island Park
13. Lawrence
14. Lynbrook
15. Malverne
16. Rockville Centre
17. South Floral Park
18. Stewart Manor
19. Valley Stream
20. Woodsburgh

Town of Oyster Bay

21. Bayville
22. Brookville
23. Centre Island
24. Cove Neck
25. Farmingdale
26. Lattingtown
27. Laurel Hollow
28. Massapequa Park
29. Matinecock
30. Mill Neck
31. Muttontown
32. Old Brookville
33. Oyster Bay Cove
34. Sea Cliff
35. Upper Brookville

Town of North Hempstead

36. Baxter Estates
*37. East Hills (Oyster Bay)
38. East Williston
39. Flower Hill
40. Great Neck
41. Great Neck Estates
42. Great Neck Plaza
43. Kensington
44. Kings Point
45. Lake Success
46. Manorhaven
47. Mineola
48. Munsey Park
*49. New Hyde Park (Hempstead)
50. North Hills
*51. Old Westbury (Oyster Bay)
52. Plandome
53. Plandome Heights
54. Plandome Manor
55. Port Washington North
56. Roslyn
57. Roslyn Estates
*58. Roslyn Harbor (Oyster Bay)
59. Russell Gardens
60. Saddle Rock
61. Sands Point
62. Thomaston
63. Westbury
64. Williston Park

CITIES IN NASSAU COUNTY

65 City of Glen Cove
66. City of Long Beach

VILLAGES IN SUFFOLK COUNTY

Town of Huntington

67. Asharoken
68. Huntington Bay
69. Lloyd Harbor
70. Northport

Town of Babylon

71. Amityville
72. Babylon
73. Lindenhurst

Town of Smithtown

74. Head of the Harbor
75. Nissequogue
76. Village of the Branch

Town of Islip

77. Brigthwaters
78. Ocean Beach
79. Saltaire

Town of Brookhaven

80. Belle Terre
81. Bellport
82. Lake Grove
83. Old Field
84. Patchogue
85. Poquott
86. Port Jefferson
87. Shoreham

Town of Southampton

88. North Haven
89. Quogue
*90. Sag Harbor (East Hampton)
91. Southampton
92. Westhampton Beach

Town of Southold

93. Greenport

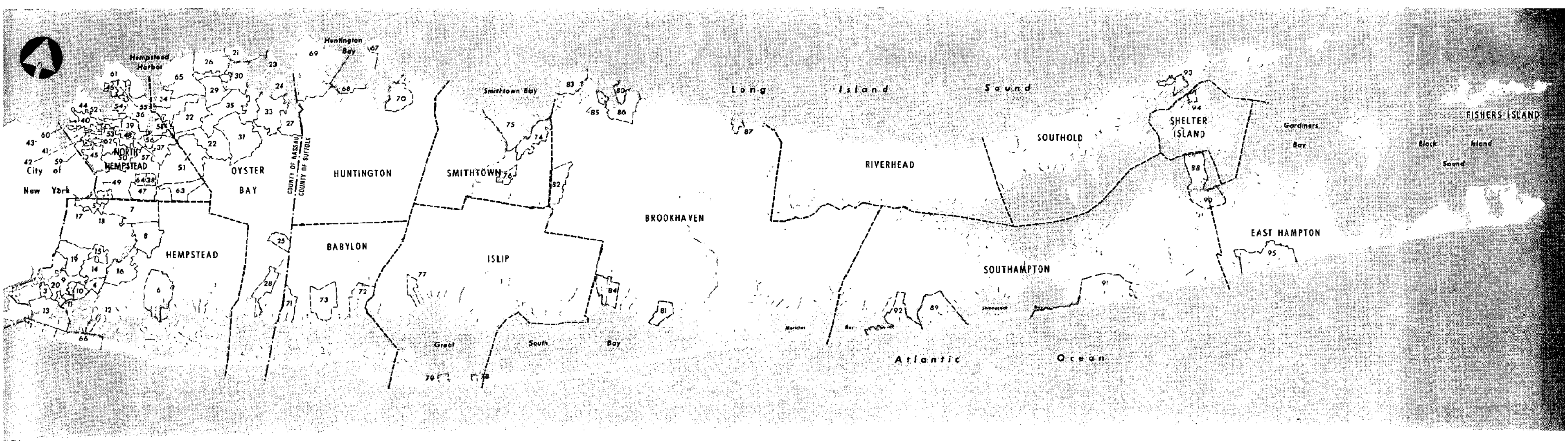
Town of Shelter Island

94. Dering Harbor

Town of East Hampton

95. East Hampton

**Incorporated Villages situated within two towns*



Nassau and Suffolk Counties—Municipal Boundaries

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Preface

Long Island is highly vulnerable to the occurrence of a hurricane disaster of immense proportions. The data and information in this hurricane damage mitigation plan for the Island's south shore substantiate this ominous prediction. The concept for this plan was originally developed by the Long Island Regional Planning Board's Marine Resources Council in its report, *Guidelines for Long Island Coastal Management*, published over a decade ago.

Hurricanes and northeast storms are not rare events in the history of Long Island. National Weather Service data indicate that the Island has been directly impacted by seven hurricanes and 15 tropical storms since 1886. Northeast storms causing significant water-related damage occur nearly every year. Unusually severe storms occur in the area about three times every century.

Coastal areas on Long Island have experienced dramatic residential and commercial development and change in recent years. As a result, the Island's south shore is far more vulnerable to storm-related damage and potential loss of life today than it was 46 years ago when the devastating hurricane of September 21, 1938 destroyed Westhampton Beach and other shoreline communities. This is despite the fact that early warning systems and hurricane forecasting techniques are now in place, and shoreline communities currently participate in the National Flood Insurance Program.

The extent to which damage will occur from a hurricane will depend upon many factors, including magnitude of the storm, its duration, and other characteristics. The time and location of hurricane landfall cannot be predicted with certainty. What is certain, however, is that the damage and suffering will be staggering, and even worse, the event will occur in the future. Long Island has the potential to become the next site of the Nation's **costliest hurricane disaster!**

The implementation of the strategies and government program modifications recommended in this plan will help to mitigate and reduce storm-related damage and suffering by improving development practices in the floodplain. Implementation opportunities exist as development occurs, as well as after severe storm occurrence during the re-development process. In this sense, the plan provides examples of how to integrate hurricane preparedness concerns into the coastal land use planning process at the local level.

Executive Summary

There is a real and present threat of a hurricane impacting the highly developed south shore of Long Island. Recognizing this threat, the *Federal Emergency Management Agency* (FEMA), Region II provided funds for the *Long Island Regional Planning Board* (LIRPB) to develop a plan which, if implemented, would minimize the loss of life and property in flood-prone areas.

The area chosen for study is the 100-year storm tidal floodplain along the south shore of Nassau and Suffolk Counties, as identified on the *Flood Insurance Rate Maps* (FIRMs) prepared under the *National Flood Insurance Program* (NFIP). While inland areas may suffer wind and rain damage during severe storm events, the most devastating impacts of such storms occur along coastal areas—especially barrier islands—where flooding and wave action add to the destruction caused by high winds.

In developing the recommended strategies and program modifications of the plan, the LIRPB was guided by the following study goals:

- minimize the potential loss of life
- preserve and protect areas in their natural state that are vulnerable to flooding during severe storms
- minimize adverse economic impacts resulting from severe storm floods
- minimize future government expenditures for post-storm disaster recovery assistance
- discourage redevelopment of areas subject to severe flood loss when the public benefits of doing so (i.e., protection of life, property and government investment, and/or provision of recreational opportunity) outweigh the positive aspects of private coastal occupancy, such as local economic impacts and the amenities of shoreline living.

The recommended strategies of the plan provide a set of guidelines for development and post-storm redevelopment, emphasizing the techniques of floodplain management. Those emergency activities undertaken immediately before and after severe storm events—the issuance of hurricane warnings, evacuating people from flood-prone areas, search and rescue operations—are not the focus of this study.

The information and strategies presented in this plan are intended to be used by those groups, e.g., local planning boards, that are not specifically concerned with hurricane preparedness, as well as by those who deal with this topic on a regular basis. In addition, this document will prove useful to the work of the *Federal Interagency Regional Hazard Mitigation Team* (HMT) in the preparation of its Hazard Mitigation Report after the occurrence of a storm disaster.

The vulnerability of the south shore to severe storm events is documented in Chapter 2. The probability that at least one tropical storm will impact the Long Island area during the next 10 years ranges from 0.85 to 0.96, indicating the high likelihood of such an event in the next decade. The probability that at least one storm of hurricane magnitude will impact this area in this time period is slightly less, ranging from 0.5 to 0.8. Northeast storms can also cause significant coastal impacts; in a given year there is roughly an 80% chance that a northeast storm will occur that causes significant water-related damage in New York. On the average, unusually severe storms occur in the region about three times a century.

Characteristics of significant tropical cyclone and northeast storm events impacting Long Island are included in this plan. Most of the damage to shoreline development in severe storms results from storm surge flooding. Along the south shore, tide elevations associated with the 100-year tidal floodplain range up to 18 ft above *National Geodetic Vertical Datum* (NGVD), depending upon location and topography.

The acreage of various types of land use in the 100-year floodplain is presented. The south shore tidal floodplain comprises 69,701 acres; approximately one-third of the floodplain is located within the **V** zone, and thus is subject to both flooding and wave action. There are 6,658 acres of vacant property in the 100-year floodplain. The predominant land uses are residential and recreation.

The value of structures and population at risk in the south shore **A** and **V** zones was determined. The results indicate a total single and two-family residential structural value in the south shore floodplain of over $3 billion. Structures in the **V** zone account for over $300 million of this total; most of these are located on Long Island's five south shore barrier islands. The total value of multi-family residential structures was estimated at $62 million. The structural value of commercial and industrial buildings in the floodplain was estimated at $140 million. These values are indicative of the potential structural value at risk in the event of a major storm event, rather than projections of actual flood damages. It should be noted that personal property, inventories and public investments, e.g., infrastructure, are not included in these estimates.

The 1980 population in Nassau County's 100-year floodplain consists of 74,879 year-round residents and an additional 750 seasonal residents. In Suffolk County there are 34,818 year-round residents and an additional 34,344 seasonal residents.

In 1980, there were nearly 110,000 year-round residents in the 100-year floodplain along the south shore of Nassau and Suffolk counties. In the summer, an additional 35,000 residents are found in resort communities along the shore. All of these people would be subject to the high winds, waves and flooding associated with severe storms.

Chapter 3 presents the recommended strategies for six south shore coastal reaches and detailed study areas. They offer solutions to both short-term and long-term problems regarding development and redevelopment of coastal areas. One major strategy that is applicable to all flood hazard areas is the need for communities to adopt provisions for instituting temporary development moratoria in flood zones during post-storm periods. Such moratoria will allow communities to temper the immediate post-storm desire to rebuild structures as quickly as possible, and give them time to implement redevelopment plans that would mitigate recurring storm damage.

The strategies listed for each reach include recommendations in the areas of erosion and flood control measures, land use and development patterns, land acquisition strategies, environmental regulations, the National Flood Insurance Program and other regulatory programs, and evacuation, warning and public education. Reach strategies have been applied to the detailed study areas on a site-specific basis. The detailed study areas typify the characteristics and most severe flooding and development problems of the reach. The following is a brief synopsis of the recommendations for each reach and its respective detailed study area:

REACH #1—*Long Beach Barrier Island*

Long Beach Island is dominated by artificial shore protection structures, such as groins and jetties; land use is characterized by high density development. *Flood Insurance Rate Maps* (FIRMs) designate the City of Long Beach outside of the 100-year floodplain. However, topographic maps and prior flooding events indicate that the 100-year floodplain boundary may be incorrectly drawn. Thus, it is strongly recommended that FEMA re-map the Long Beach barrier island in order to correct this inadequacy.

DETAILED STUDY AREA: *West Long Beach (City of Long Beach/ Town of Hempstead)*

It is recommended that the beach be maintained through a program of beach nourishment, and the existing groins repaired and strengthened. Should homes be destroyed in a storm event, extension of the man-made dune system, which is present to the west, should be considered in conjunction with the clustering of residential units away from the ocean or bay shorelines.

REACH #2—*Jones Beach Barrier Island*

Jones Beach Island is designated on FIRMs as almost entirely within the **V** zone, and is subject to intense wave and flooding effects in the event of a storm. The entire reach is publicly owned and is used predominantly for recreational uses; however, there are residential areas at West Gilgo Beach, Gilgo Beach, Oak Beach, Oak Island and Captree Island where individuals and leaseholder associations have leased land from the Town of Babylon and constructed private houses. It is recommended that Town owned land, currently leased to private homeowners, should eventually be returned to public recreational use and natural resource protection.

DETAILED STUDY AREA: *Gilgo/Oak Beach (Town of Babylon)*

The Town of Babylon should not grant new leases or permit additional construction on leased property in these now predominantly year-round residential areas. In addition, the Town should never sell this publicly owned land to current or future leaseholders or private interests. Accommodations for public access and additional recreational facilities should be expanded on these Town owned properties as required.

REACH #3—*Fire Island*

Fire Island has a predominantly natural shoreline, an extensive but irregular dune system, 20 private residential summer communities, and a large wilderness area owned by the Federal government as part of the *Fire Island National Seashore* (FINS). There should be a limit to public expenditures on Fire Island for artificial shoreline maintenance, except where it may be necessary to close or prevent the opening of a new inlet. Development/redevelopment should be prohibited within a uniform, dynamic dune district.

DETAILED STUDY AREA: *Village of Saltaire to Lonelyville (Town of Islip)*

Due to long-term shoreline erosion, only the landward flank of the dunes remains to protect these communities. Should a significant number of oceanfront houses be damaged or destroyed in a storm event, Saltaire and the Town of Islip should prohibit the rebuilding of these houses in the same location, and instead encourage the clustering of development at less vulnerable inland locations. The possibility of using certain FINS parcels for post-storm redevelopment should be explored.

REACH #4—*Westhampton Barrier Island*

The most significant problem along this reach is the severe erosion along the ocean shoreline of the unincorporated portion of Westhampton Beach. New inlets or breaches of the barrier island caused by storms should be closed on an emergency basis. Should the site of a new inlet include private property, such property should be condemned prior to repair to prevent future development on a vulnerable area.

DETAILED STUDY AREA: *Westhampton Beach (Town of Southampton)*

Solutions to the erosion problems at Westhampton Beach must involve a combination of structural and non-structural measures. Non-structural strategies include the public acquisition of properties after substantial structural damage occurs. This strategy should be instituted over the short-term.

REACH #5—*Shinnecock Inlet to Montauk Point*

There are few erosion control structures along the shoreline of the easternmost reach of the study area. The remaining vacant parcels in the flood hazard areas are subject to extensive pressure for new residential and commercial development. A major strategy for this reach includes minimizing public investments for beach stabilization. Any inlets which form at Napeague should be closed. Public open space should be expanded in locations vulnerable to overwash and flood damage.

DETAILED STUDY AREA: *Napeague (Town of East Hampton)*

The structures located on Napeague Bay between Cherry Point and Lazy Point are highly vulnerable to flooding. It should be public policy to severely limit any additional development in this area, and to phase out housing on lands owned by the Town of East Hampton Trustees. This land could then be retained for public access and recreational use.

REACH #6—*Mainland and Bay Island Areas*

The mainland coastal reach is characterized by extensive residential development. Many houses in the **A** zone were built at grade or below and have experienced repeated flooding. It may be cost-effective to raise these structures above the base flood elevation. FEMA should examine the long-term benefits of providing a grant or loan for such purposes.

DETAILED STUDY AREA: *Mastic Beach (Town of Brookhaven)*

The scattered residences suffering repeated flood damage that are located immediately adjacent to wetlands should be removed and relocated to suitable inland locations owned by the Town of Brookhaven or Suffolk County.

Chapter 4 presents an analysis and suggested modifications for three government programs which critically affect development and post-storm redevelopment along Long Island's south shore floodplain. The following is a brief summary of these programs and recommended changes.

NATIONAL FLOOD INSURANCE PROGRAM

The Federal government should modify the NFIP to phase out flood insurance in **V** zones. Current policy holders whose structures are damaged greater than 50% of structural value, should receive a final payment equal to the full value of their structures, up to the policy limit, if they agree not to rebuild in the **V** zone. If they elect to rebuild in the same **V** zone location, payments would reflect actual structural damage, but further NFIP coverage would no longer be available. In addition, FEMA should delineate the boundaries of the flood zones with greater precision on the FIRMs. It is also recommended that NFIP floodplain management criteria be amended to require communities to impose a building moratorium in instances of large-scale storm damage. Finally, FEMA, in cooperation with the National Weather Service, should expand the tidal gauge network on Long Island, to provide expanded data and improved forecast and warning capabilities.

COASTAL BARRIER RESOURCES ACT (CBRA)

The CBRA prohibits Federal expenditures on and financial assistance (in the form of grants, loans, loan guarantees, and insurance) for development of coastal barriers, or portions thereof, which are not presently developed. Under CBRA, an undeveloped coastal barrier can not be designated if it is **otherwise protected,** such as those areas held by a government agency or qualified group for wildlife refuge or natural resource conservation purposes. It has been recommended that the Federal government include the **otherwise protected** areas within CBRA and, thereby, eliminate Federal expenditures on and financial assistance for development of privately owned properties that are within the boundaries of conservation areas.

NEW YORK STATE COASTAL EROSION HAZARD AREAS ACT

The objective of the New York State Coastal Erosion Hazard Areas Act is to prohibit certain activities and construction in designated erosion hazard areas. Implementation of this legislation would be facilitated if monies are made available to localities for the purchase of certain properties in erosion hazard areas. Sources of funding would include the presently defunct constructive total loss program and section 1362 of the NFIP.

Chapter 5 reviews various Federal and New York State programs which provide emergency assistance and recovery aid. A guide was prepared that shows which Federal aid programs may potentially be utilized for various types of mitigation and recovery actions, and which programs can be expected to meet various types of disaster assistance needs following a major storm.

Chapter I....

Introduction

1.0 FEDERAL EMERGENCY MANAGEMENT AGENCY PREPAREDNESS PROGRAM

Hurricanes are perhaps the most awesome and potentially destructive of all natural phenomena. For residents of coastal areas which must co-exist with the threat of hurricanes and coastal storms, there are a variety of responses available to reduce, or mitigate, the destructive forces of these storms. Federal, State and local governments have developed a wide range of mitigation actions including:

- structural measures (e.g., construction of dunes, seawalls, coastal protection structures, channel and inlet stabilization)
- improvement of structures and facilities at risk through use of building codes that reflect the hazards of coastal occupancy and require, for example, floodproofing
- non-structural measures, such as identification of hazard-prone areas and standards for prohibited or restricted use (e.g., floodplain regulations, hazard mitigation plans)
- loss recovery and relief programs (e.g., insurance, disaster grants and housing, low interest loans)
- hazard warning and population protection (e.g., emergency preparedness programs and training, public information, evacuation, relocation).

The *Federal Emergency Management Agency* (FEMA) has primary responsibility for the implementation of the *National Flood Insurance Program* (NFIP), the *Disaster Relief Act of 1974,* and other programs of support to State and local governments that are designed to improve emergency planning, preparedness, mitigation response, and recovery capabilities in a disaster or emergency situation. FEMA's Disaster Preparedness Assistance Program provides financial assistance for the development of preparedness plans for hurricanes (and other types of natural disasters) in high-risk, high-population areas (44 CFR Part 300.6). The objective of this program is to prepare plans and capabilities for achieving better response to the threat or consequences of hurricanes in high risk areas.

The Long Island/New Jersey barrier coast was identified by FEMA as one of the hurricane-prone areas nationwide which could benefit through the development of a preparedness plan. A proposal submitted to FEMA by the Long Island Regional Planning Board (LIRPB) for the preparation of a hurricane damage mitigation plan for the south shore of Nassau and Suffolk Counties was approved and funded by FEMA, Region II; work on the plan was initiated by the LIRPB in January, 1983.

1.1 GOALS OF THE STUDY

The strategies and program modifications recommended in this plan were developed by the LIRPB to mitigate damage by identifying actions that should be taken before, and in response to, the occurrence of a hurricane or severe northeast storm disaster in the Nassau-Suffolk region. The recommended strategies and program modifications were prepared in light of the following study goals:

- minimize the potential loss of life
- preserve and protect areas in their natural state that are vulnerable to flooding during severe storms
- minimize adverse economic impacts resulting from severe storm floods
- minimize future government expenditures for post-storm disaster recovery assistance
- discourage redevelopment of areas subject to severe flood loss when the public benefits of doing so (i.e., protection of life, property and government investment, and/or provision of recreational opportunity) outweigh the positive aspects of private coastal occupancy, such as local economic impacts and the amenities of shoreline living.

In order to achieve these goals, this plan identifies flood hazard areas; estimates the population, and number and value of structures at risk; recommends land use alternatives for both future coastal development and the redevelopment which would occur in the wake of a 100-year storm event; and analyzes Federal, State and local legislation, ordinances and regulations to determine their potential impact on the development or redevelopment of coastal flood hazard areas. The recommended strategies provide a set of guidelines for development and post-storm redevelopment; the recommended program modifications would adjust government agency actions and regulatory activities. If utilized and adopted, the recommendations would adjust the private and public sector response to severe storm events so as to make it more compatible with the goals outlined above.

The emphasis on floodplain management reflects the LIRPB's expertise in land use and coastal development issues on Long Island. Those emergency activities undertaken immediately before and after severe storm events—the issuance of hurricane warnings, evacuating people from flood-prone areas, search and rescue operations, provision of emergency housing and medical care—are not the focus of this plan. Work on the plan was, however, coordinated with those agencies responsible for emergency activities on Long Island.

1.2 FLOODPLAIN MANAGEMENT APPROACHES

1.2.1 The Structural Approach. There have been a variety of approaches taken by Federal, State and local governments to reduce flood-related losses on public and private lands in the United States. Throughout the 1950's and 1960's, structural flood control works such as levees, seawalls, hurricane barriers and channel improvements, were constructed by the *U.S. Army Corps of Engineers* (COE). COE projects in coastal areas were designed to *stabilize the shores of large bodies of water where wave action is the principal cause of erosion* (U.S. Army Corps of Engineers, 1973: 1-1). They have been criticized for causing adverse environmental effects, and encouraging additional unwise coastal development by creating a false sense of protection and security from storms. In fact, despite a federal investment of over $10 billion in structural flood control measures since 1946, average annual flood losses have continued to increase (U.S. Water Resources Council, 1979).

1.2.2 The Do-Nothing Approach. A different response to the threat of coastal storms and erosion is the do-nothing or laissez-faire approach predicated on the philosophy that coastal storms and shoreline erosion should be accepted as inevitable. Under this philosophy, coastal systems would be allowed to function naturally without any interference, and structures subject to damage or destruction from erosion or coastal storms would not be protected by structural flood control measures. The do-nothing approach is advocated by those who feel that structural measures often cost more than the value of property to be protected, and that once the structural protection route is chosen, it must be followed and maintained indefinitely.

1.2.3 The Non-Structural Approach. In the past decade, governmental agencies have recognized that attempts to stabilize inherently dynamic coastal shorelines have sometimes resulted in ever increasing costs. Instead of adopting the **do-nothing** approach, though, a number of non-structural floodplain management measures have been developed for use in place of, or in conjunction with, structural flood control works. Federal initiatives such as the National Flood Insurance Program (NFIP), Section 406 of the Disaster Relief Act of 1974, and Executive Orders 11296 and 11988 (Floodplain Management), all direct attention to the use of non-structural floodplain regulations to reduce flood losses.

1.2.4. The Approach Taken in This Study. A successful floodplain management program must incorporate a wide variety of available mitigation measures, which must be screened to identify those appropriate to a particular location and set of circumstances. The LIRPB recognizes that a hurricane damage mitigation plan for a high risk, high population area, such as the south shore of Long Island, must strike a balance among preservation, development, and restoration interests. Conflicts involving these interests are inherent in the management of the coastal zone, where it is the national policy to *preserve, protect, develop, and where possible, to restore or enhance* coastal zone resources (Coastal Zone Management Act of 1972, P.L.92-583, Sec. 303).

The LIRPB has attempted to tailor a combination of floodplain management strategies for the south shore of Long Island based on a site specific analysis of:

- the hurricane threat and vulnerability to damages
- the condition of the natural system and its ability to buffer storm effects
- the extent of coastal development
- developmental trends

Non-structural mitigation measures are emphasized, but structural solutions are sometimes recommended where the public benefit clearly outweighs the short- and long-term costs. The site specific recommendations in this report reflect an accommodation of different concerns, and reflect three important facts.

- Land use and the intensity of development vary along the Long Island south shore
- The shoreline itself varies in form as well as response to erosion/accretion processes
- Agency and municipal programs and controls pertaining to the shoreline differ in content as well as philosophy.

1.3 PROJECT WORK PLAN

The work plan for this study involved the preparation of 10 separate technical reports based on four discrete tasks. The tasks and task reports are identified below:

TASK 1 — CONDUCT VULNERABILITY ANALYSIS TO DETERMINE HURRICANE LOSSES

- Task 1.A Report – Characteristics and Impacts of Historical Storm Events
- Task 1.B Report – Identification of Flood Hazard Zones
- Task 1.C Report – Inventory of Land Use by Acreage in Flood Hazard Zones
- Task 1.D Report – Inventory of Structures by Land Use Category in Flood Hazard Zones
- Task 1.E Report – Value of Structures by Land Use Category and Population at Risk in Flood Hazard Zones

TASK 2 — DEVELOP HURRICANE CONTINGENCY PLAN RECOMMENDATIONS

- Task 2.A Report – Objectives, Strategies and Applicable NYS Coastal Policies
- Task 2.B Report – Draft Strategies and Recommendations by Coastal Reach and Detailed Study Area
- Task 2.C Report – Analysis of Federal and State Disaster Assistance Programs

TASK 3 — PUBLIC PARTICIPATION

- Task 3 Report – Public Participation

TASK 4 — FINAL REPORT

Task 4 Report– Hurricane Damage Mitigation Plan for the South Shore of Nassau and Suffolk Counties, New York

This plan document constitutes the Task 4 report, which incorporates information from the nine previous task reports. In addition, a supplemental report on hurricane evacuation problems along the south shore was prepared, excerpts of which are included within this final report.

1.4 USES OF THE HURRICANE DAMAGE MITIGATION PLAN

1.4.1 Local Uses. The information and strategies presented in this study are intended to be used by those groups, e.g., local planning boards, that are not specifically concerned with hurricane preparedness, as well as by those who deal with this topic on a regular basis. This document should help to instill an increased awareness among the general population and citizen groups of the vulnerability of Long Island to hurricanes and coastal storms, the costs of coastal development, and the opportunities available to mitigate future damages. Local governments can use the recommendations of this report to initiate changes in coastal land use affecting both continuing development and post-storm redevelopment, thereby protecting their citizens, and minimizing the social, economic and environmental costs of hurricanes and coastal storms. This document is not intended to be a detailed blueprint for a hurricane preparedness program, but rather a broad menu which presents a range of hurricane damage mitigation opportunities.

1.4.2 Federal/State Uses. The applicability of this study to Federal and State damage mitigation/disaster assistance efforts is twofold. First, suggested modifications are offered for selected government programs. These recommendations for change are intended to correct inadequacies or inconsistencies in the programs.

This document will also prove useful to the work of the *Inter-agency Regional Hazard Mitigation Team* (HMT) in the preparation of its Hazard Mitigation Report after the occurrence of a storm disaster. This inter-agency task force is mobilized in the event of a Presidentially-declared disaster, and the report it subsequently prepares is incorporated by FEMA and various Federal agencies in post-storm funding decisions. The purpose of this Federal effort is to target post-disaster Federal investment so that future flood losses are reduced.

Much of the background information required by the HMT in the preparation of its Hazard Mitigation Report is contained herein. Ways in which this study can assist the HMT include the following:

- HMT members will need to be familiar with local mitigation opportunities and local issues. The 15-day time period alloted for the report preparation is too short to permit thorough evaluation without advance knowledge of the problem areas and potential mitigation alternatives. This report provides a range of potential and recommended site-specific mitigation alternatives.

- The HMT handbook of common procedures (FEMA, 1981) states that mitigation recommendations are more likely to be accepted if the states and communities have already considered mitigation opportunities. This study will be made available to Long Island municipalities, giving them the opportunity to evaluate recommended strategies in terms of consistency with local community plans and programs.

- Following a Presidential disaster declaration, the HMT sends an advance team into the affected areas to obtain information on damages, vulnerability and mitigation opportunities. The team needs insight into the amounts, types and causes of flooding in order to select areas for implementation of mitigation actions that will result in the greatest potential to reduce future flood losses.

This study contains a series of maps, an analysis of vulnerability, and an identification of potential mitigation opportunities. The study, then, is a primary source of information and ideas for the HMT in its deliberations. In fact, the task reports prepared under the contract for this study were utilized by the Region II Interagency Hazard Mitigation Team in preparing its Hazard Mitigation Report in response to the 28-30 March 1984 northeast storm and subsequent Presidential declaration of emergency. Overall, the conclusions of the HMT report were in agreement with the strategies contained in this study.

1.5 REFERENCES

Federal Emergency Management Agency. 1981. Flood hazard mitigation: handbook of common procedures-interagency hazard mitigation teams. Report No. FEMA-14. Washington, D.C.

U.S. Army Corps of Engineers. 1973. Shore protection manual, Vol. I. U.S. Army Coastal Engineering Research Center. Fort Belvoir, Virginia.

U.S. Water Resources Council. 1979. A unified national program for floodplain management. Washington, D.C.

Chapter 2....

Vulnerability of the South Shore to Storm Related Damage

2.0 INTRODUCTION

This section presents an overview of the susceptibility of the Long Island south shore to severe storm events. The term **storm event** as used in this study refers not only to the meteorological characteristics of a storm, but also its associated floodplain impacts, including structural damage. The nature of the impacts of severe storms in terms of the flood hazard, and as a modifier of coastal landforms, is described. Tropical and extratropical storm frequency data, and information on storm surges have been reviewed and summarized.

While it is true that inland areas suffer damage from severe storm events as a result of high winds and heavy rains, the most devastating impacts of such storms occur along coastal areas where flooding and wave action add to the destruction caused by high winds. For this reason, the geographic scope of the hurricane damage mitigation plan for the south shore of Nassau and Suffolk Counties will be limited to the 100-year storm tidal floodplain. This floodplain has been identified through the use of *Flood Insurance Rate Map* (FIRM) studies that predict the area to be flooded by the 100-year storm tide with added wave effects; it is shown on the flood hazard zone base map for this study.

The exposure of the Long Island south shore to flood and erosion-related damages associated with severe storm occurrence is described by an analysis of land use and demography in the study area. Land use by type in the study area has been tabulated in order to show the extent to which the exposure to damage can be increased in the future through the development of available vacant land. The number of structures of various types located in the study area has been tabulated; structural values have been estimated in order to define a notion of property values that could be at risk in the event of a storm. Similarly, population—both year-round and seasonal within the south shore floodplain—has also been tabulated to reflect the issues of public health and safety during a severe storm.

2.1 THE POTENTIAL FOR DISASTER

The devastating impact of the hurricane of September 21, 1938 on Long Island and in New England has been documented in several sources, including Allen (1976), Andrews (1938), Works Progress Administration (1938) and Clowes (1939). The memories and personal accounts of this storm help to point out the fact that the south shore of Long Island today is more vulnerable to storm-related damages and potential loss of life than it was in 1938, despite the fact that early warning systems and hurricane forecasting techniques are in place. To confirm this, one has only to examine and compare existing development along the south shore of Long Island to that found in 1938 (Figs. 2-1, 2-2). As the years go by, Long Island is approaching the time when a disaster of immense proportions in terms of property destruction will occur. The following quotations reflect the nature of this natural disaster as it occurred at Westhampton Beach in 1938.

> Soon after three o'clock the situation on the beaches became critical, especially on that long strip from Shinnecock Bay to Moriches Inlet where the dunes were mostly low and had at their backs a succession of bays and canals. And, as the storm approached from a bit west of south and the trend of the coast eastwards is a little north of east, the center reached Westhampton before it did points farther east, [sic]. By three the sea there was all over the beaches and beating and breaking at the foot of the dunes. By half-past three it was breaking over and through the dunes at many places and sometime toward four o'clock the final catastrophe occurred. Before the onslaught of that terrible tide, itself perhaps ten to fifteen feet above the normal height and crested with breakers towering fifteen feet higher or more, the whole barrier of the dunes crumbled and went down save for here and there where a higher dune or a strong bulkhead held. In a few minutes along the stretch of beach from Quogue village to Moriches Inlet there remained of 179 summer homes only 26 battered shells of houses of which hardly a dozen will ever be habitable again. (Clowes, 1939: 9-10)

> Shortly before four the dunes gave way before the terrible force of the roaring surf, houses collapsed, cars were tumbled like leaves, some of the stauncher houses were floated intact and whirled crazily in the core of the hurricane. Geography changed as new inlets were pushed through by the angry sea demanding an outlet for its force. For over two hours there was no difference between the Atlantic Ocean at its worst and the usually placid Moriches Bay, as the latter was swollen by the inrush of lashing water. (Clowes, 1939: 22-23)

→

Figure 2-1 (Pages 8, 9)
Pre-storm aerial (circa 1931-1933) vicinity of West End Bridge (Jessup La.) Westhampton Beach

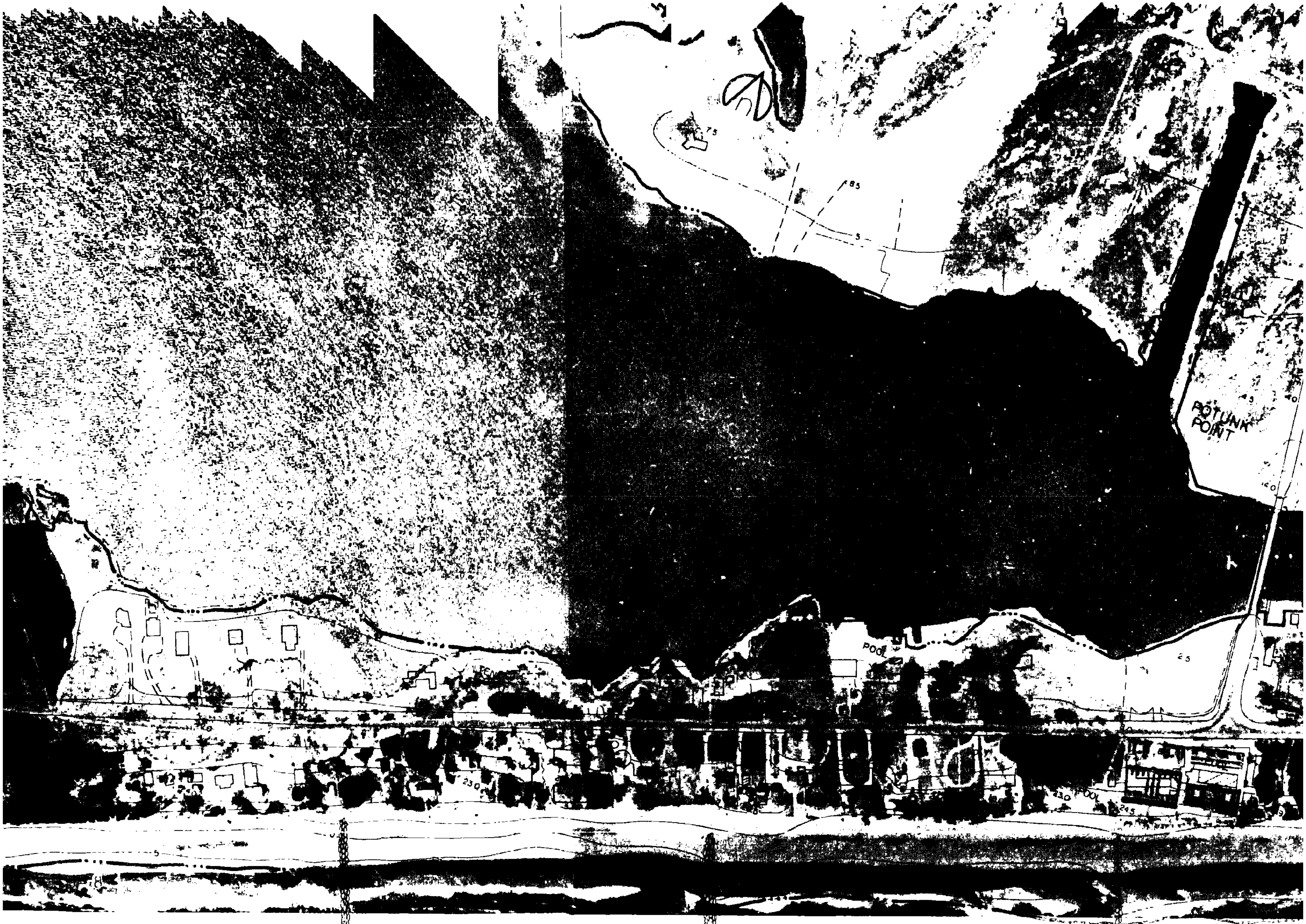
Post-storm aerial (Sept. 1938) of the same area showing the breach of the barrier beach at several locations and destruction of houses.

→

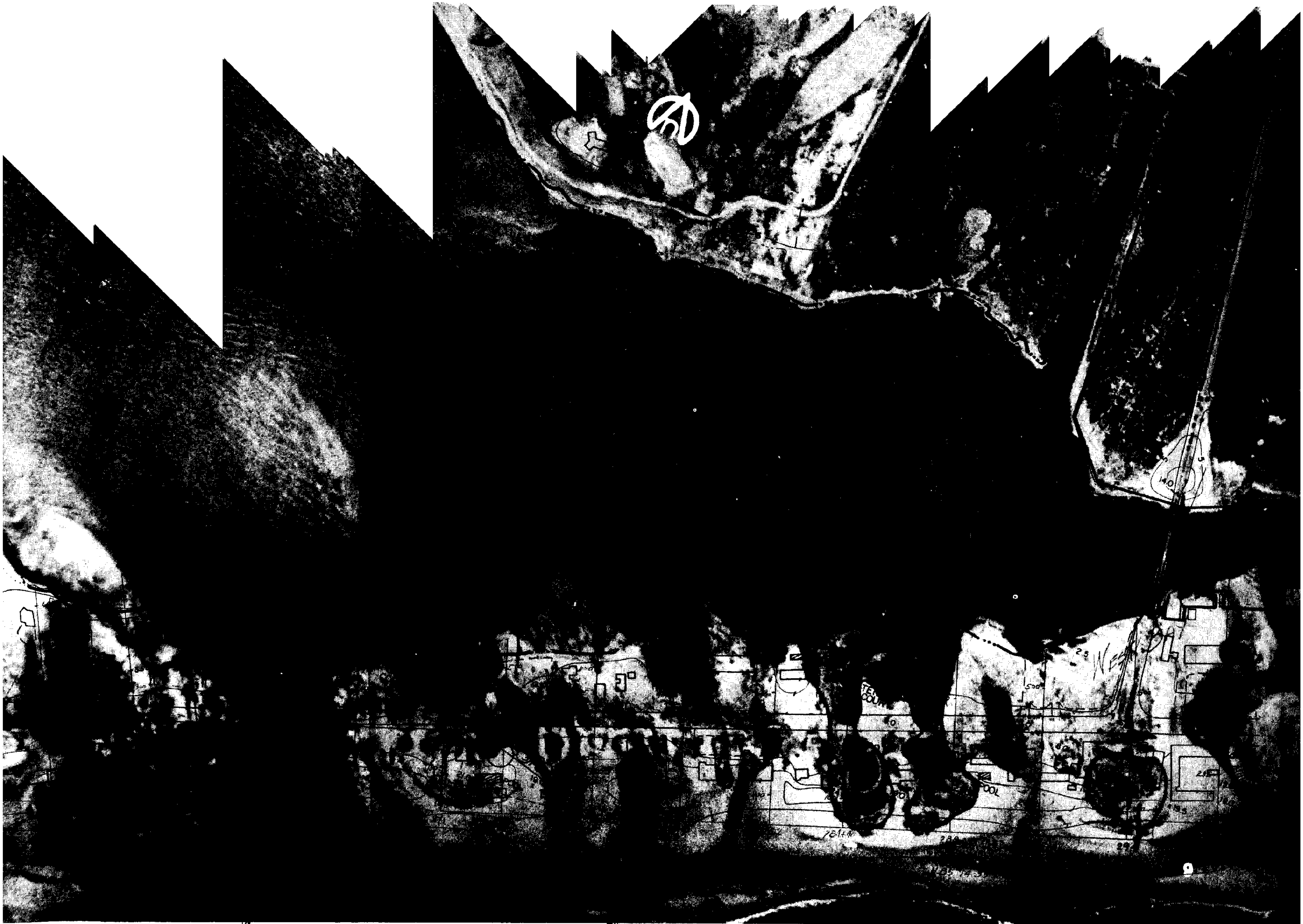
Figure 2-2 (Pages 10, 11)
(Top) *Pre-storm aerial (circa 1931-1933) prior to the creation of Moriches Inlet - Westhampton*

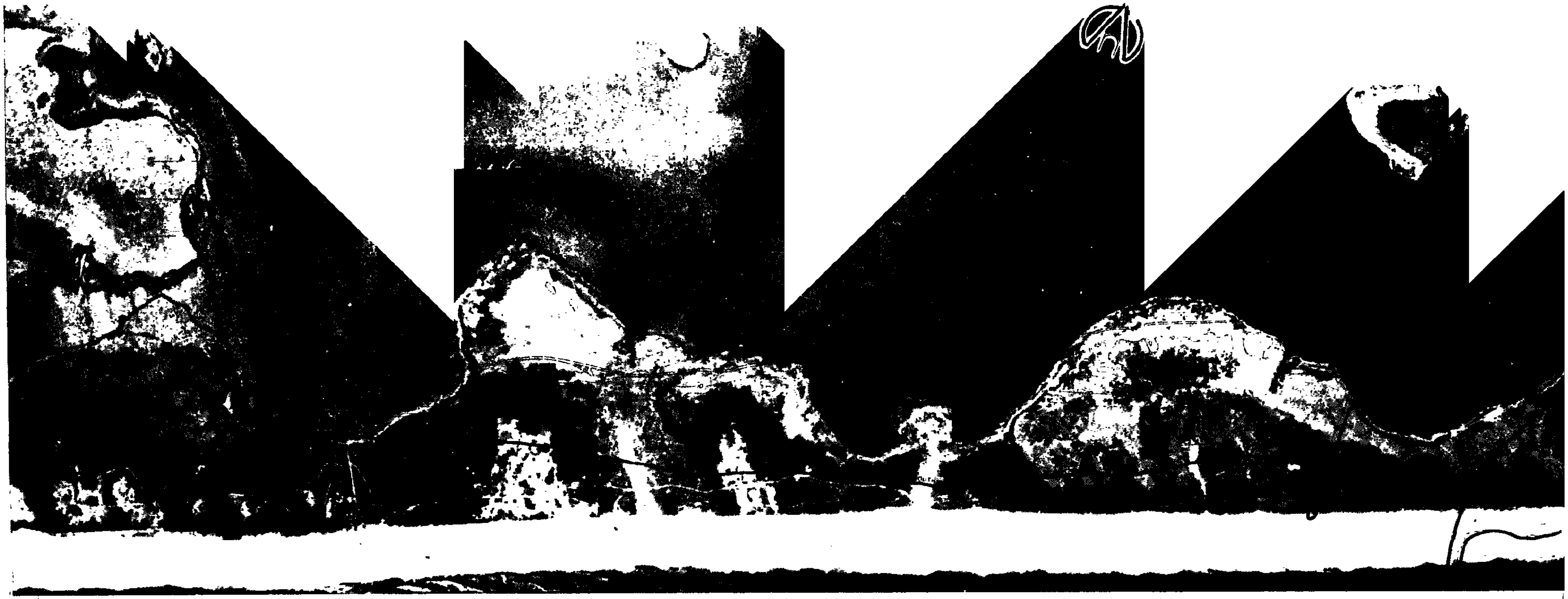
(Bottom) *Post-storm aerial (Sept. 1938) showing the breach of the barrier beach and formation of Moriches Inlet – Westhampton*

NOTE:
Information indicated in red on the aerials was taken from the 1974 Sewer Topographic Series (aerial photograph 4/8/74) and illustrates the change in land form and development in the area.



POTUNK POINT
POOL
POOL



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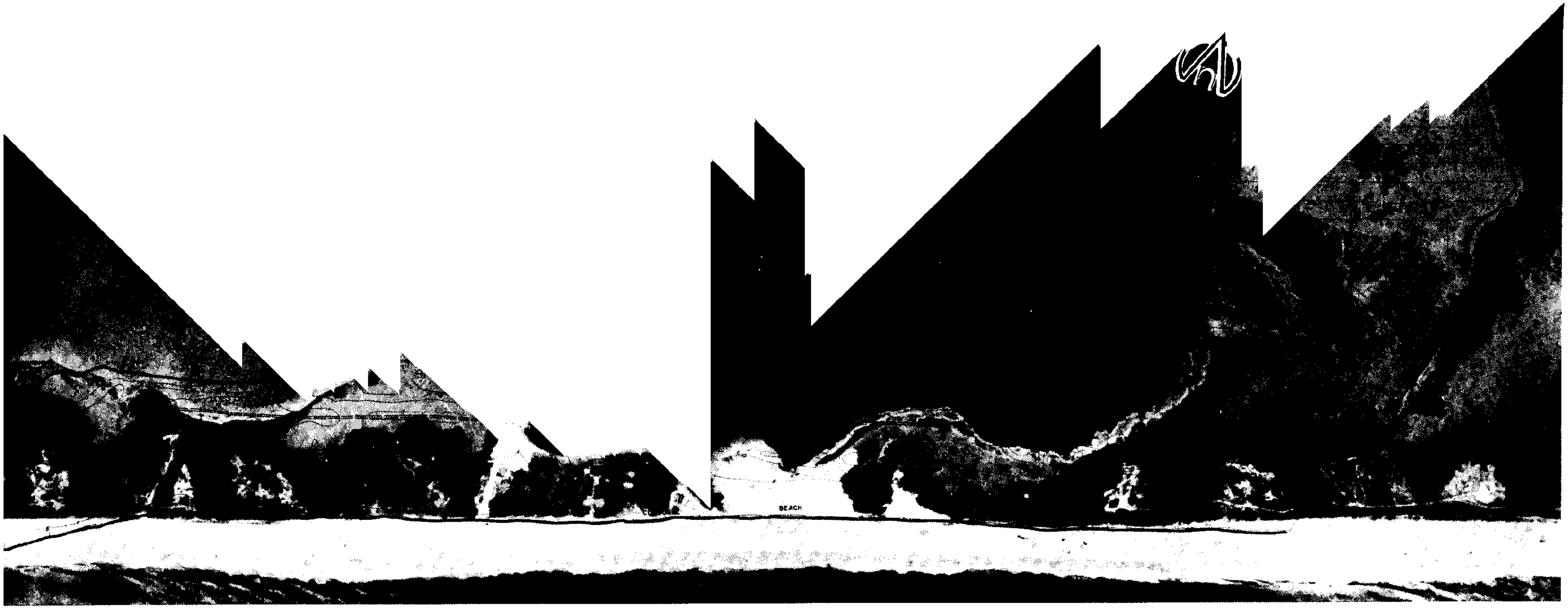
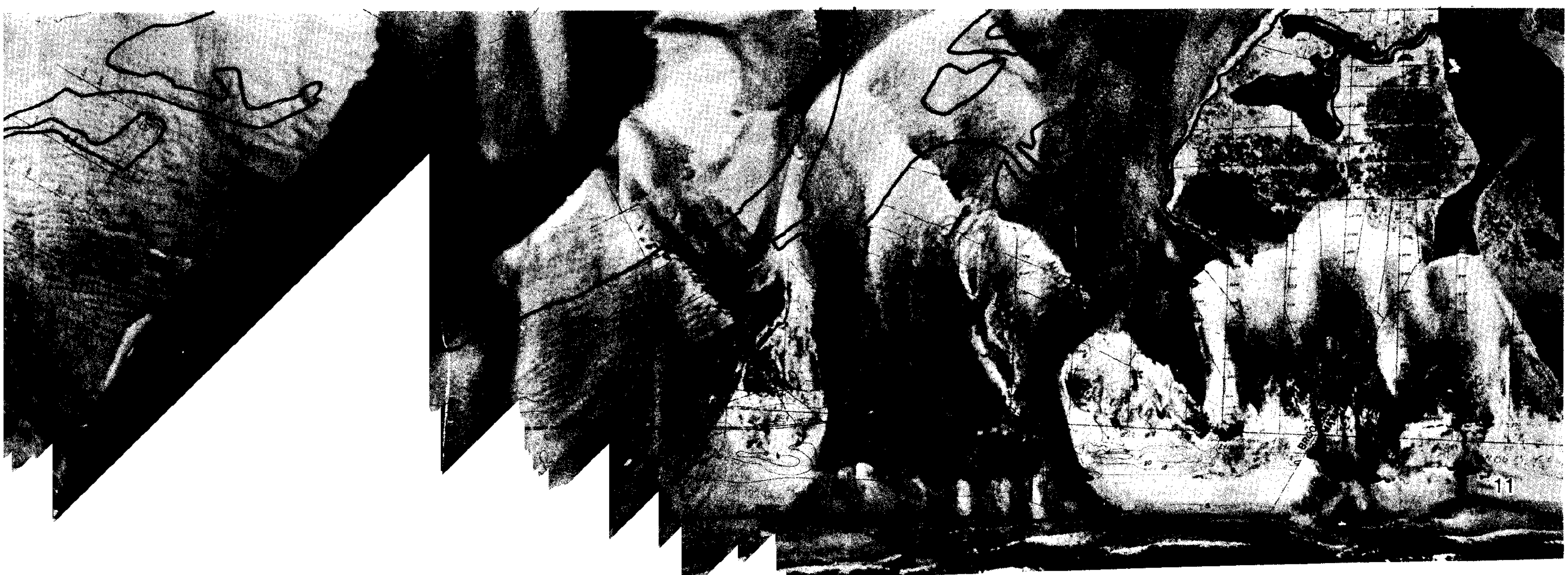

BEACH



The visual impact of the destruction wrought by this storm must have been astounding. The Long Island Regional Planning Board is indebted to Mr. Thomas Morton of Islip, N.Y. who provided copies of photographs of the Westhampton Beach area that were taken during and after the hurricane. Mr. Morton was serving in the United States Coast Guard at the Moriches station when the storm hit Long Island. He was fortunate enough to survive the destruction of the Coast Guard station and lived to tell the story of the storm; 45 other people on Long Island were not as fortunate. Eight photographs from Mr. Morton's personal collection are shown in Figs. 2-3 to 2-10.

Perhaps there is a false sense of security arising from the absence of major damage-producing hurricanes and northeasters impacting the Long Island region during the past 20 years. Indeed, many Long Island residents have had little or no experience with the effect of the storm surge and winds resulting from a major hurricane. This lack of experience makes planning for such an event very difficult. The National Weather Service has conducted studies that indicate that *as of 1980 almost 80% of U.S. coastal residents from Texas to Maine have* **never** *experienced a direct hit by a major hurricane* (Herbert and Taylor, 1983: 9). Records indicate that since 1900, four hurricanes classified as **major** have made direct hits on the New York shoreline. These storms were assigned a #3 rating on the Saffir/Simpson Hurricane Scale. A description of this scale, which relates hurricane intensity to damage potential, is shown in Table 2-1. All four major hurricanes that hit New York were travelling at forward speeds greater than 30 mph. A hurricane travelling at a high speed can cause greater damage than implied by its scale rating, depending upon whether the impacted shoreline area lies to the right or left of the storm center. Indeed, the 1938 hurricane produced results similar to a scale #4 storm because it hit the south shore of Long Island travelling north at **60 mph** (Pierce, 1939).

The potential structural damage, let alone the potential loss in life should a severe hurricane hit Long Island today, are indeed staggering. The 1938 hurricane caused $6.2 million in structural damage (1938 prices) along the south shore of Long Island from Jones Inlet to Montauk Point (U.S. Army Engineering District, New York, 1977). The vulnerability analysis conducted for this study and presented in this chapter indicates that the value of all residential, commercial and industrial structures at risk in the south shore 100-year floodplain is over $3 billion. This figure does not represent a projection of expected damages, but is merely representative of the magnitude of the value at risk. It should be pointed out that these estimates are for the coastal floodplain only, and do not include infrastructure repair and replacement and other ancillary costs.* In addition, it should be recognized that storms of greater intensity than the 1938 hurricane have hit the U.S. mainland and it is possible that such a storm could impact Long Island.

Based on the *Central Pressure Index* (CPI), a hurricane with the intensity of the 1938 hurricane (CPI of 28.00 in. of mercury) can be expected to occur in the Long Island region about once in 40 years. Use of this approach to calculate the recurrence interval of a storm does not necessarily capture the damage potential of a particular storm event. Since the 1938 hurricane hit Long Island during a rising spring tide, the water levels, and hence, damage resulting from this storm, are less frequent, i.e., have a longer recurrence interval than one would expect on the basis of storm intensity as measured by the CPI. The flood levels associated with the 1938 hurricane have a recurrence interval of 83 years.**

The 100-year tidal floodplain that defines the geographic scope of the study area in this project, is based on flood elevations that would be somewhat higher than those associated with the 1938 hurricane in the area of maximum impact. For all intents and purposes, a storm with flooding characteristics like those of the 1938 hurricane can be considered for illustration purposes as approximating a 100-year flood event.

2.2 DESCRIPTION OF THE SOUTH SHORE

The south shore of Nassau and Suffolk Counties can be divided into two physiographic sections: an eastern headlands section characterized by a narrow beach at the base of a bluff or cliff;

* Flood-related damage estimates for various storm events will be updated by the U.S. Army Corps of Engineers, N.Y. District in its reformulation study on the Fire Island Inlet to Montauk Point beach erosion control and hurricane protection project.

** Personal communication, Mr. Bruce Bergman, U.S. Army Corps of Engineers, N.Y. District.

Figure 2-3
Westhampton–
Coast Guard Dock east of Moriches Inlet

Figure 2-4
Westhampton Beach–
Barrier beach seen from southern end of West End Bridge (Jessup Lane)

Figure 2-5
Westhampton Beach–
West End Bridge (Jessup Lane)

Figure 2-6
Westhampton Beach–
Jessup Lane, near bay

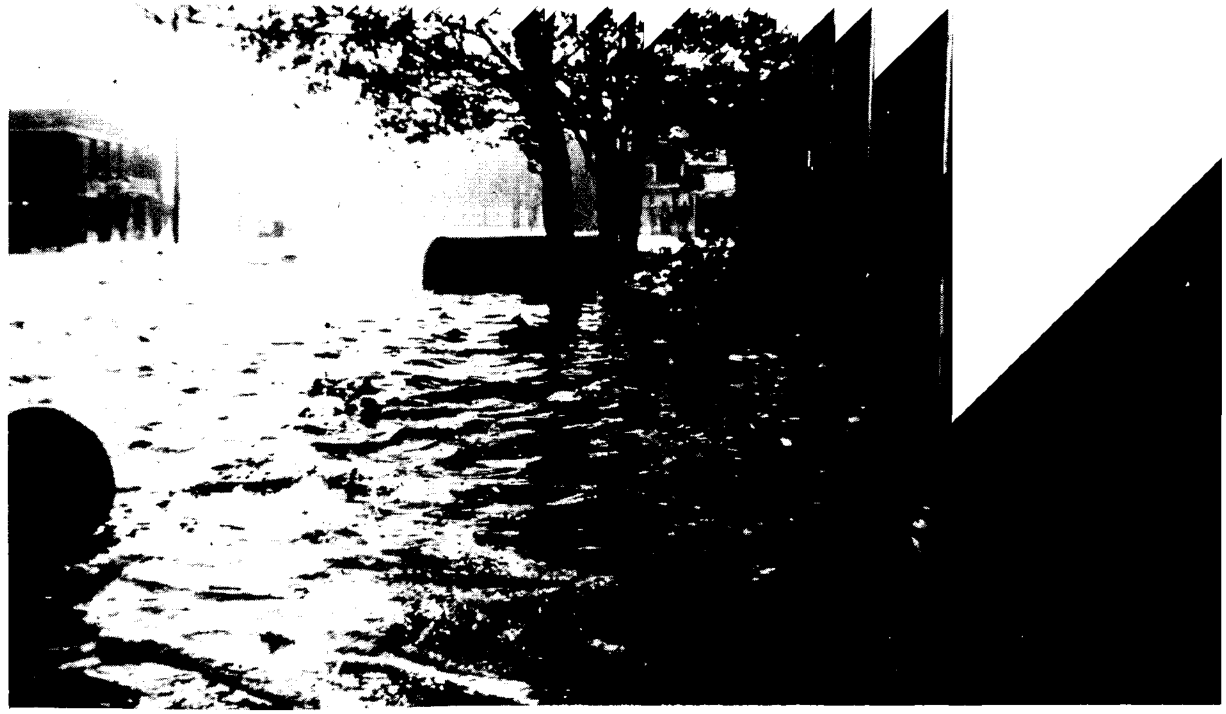


Figure 2-7
Westhampton Beach–
Main Street

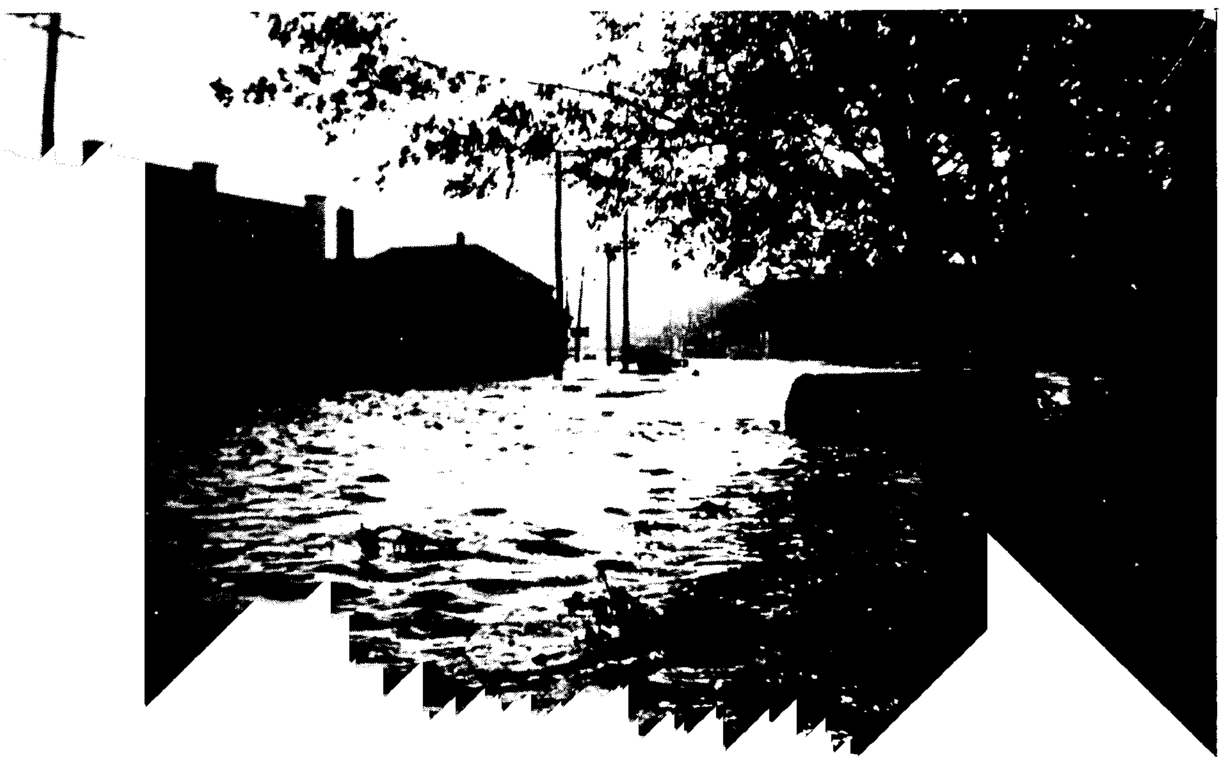


Figure 2-8
Westhampton Beach–
Main Street

Figure 2-9
Westhampton Beach–
Main Street

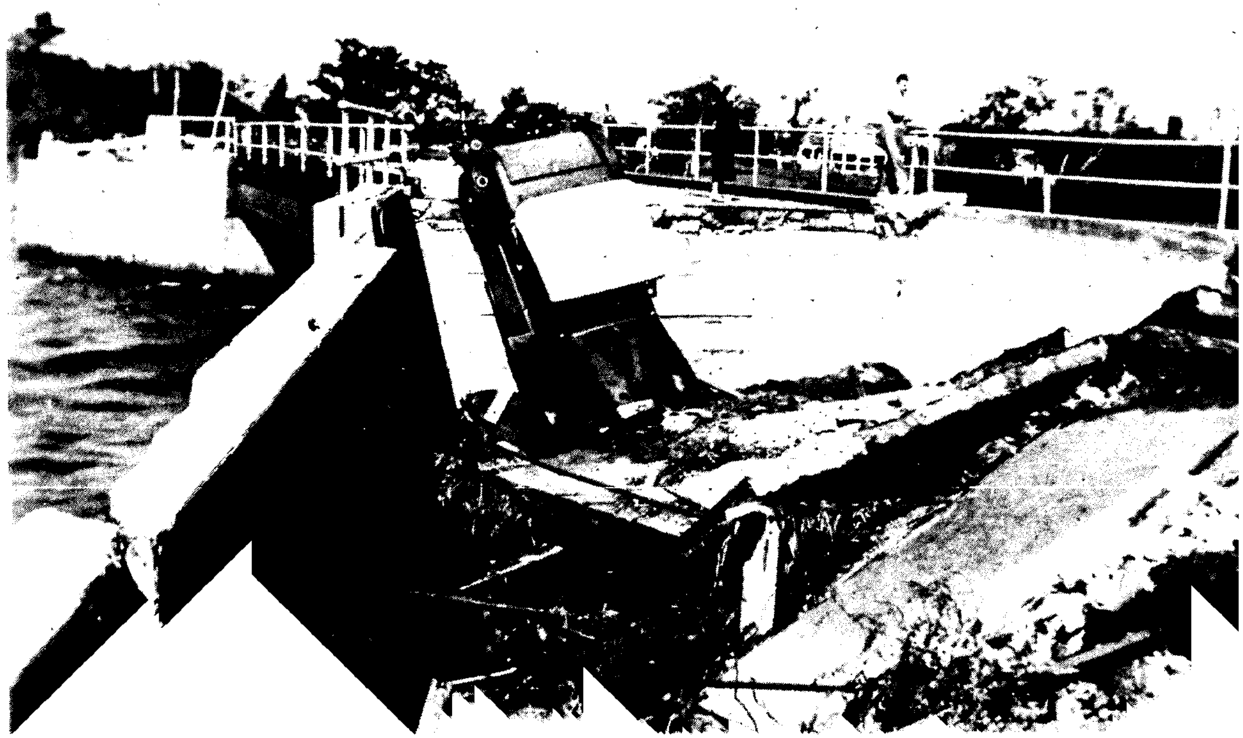


Figure 2-10
Westhampton Beach–
South Rd. Bridge over Beaverdam Creek

TABLE 2-1

The Saffir/Simpson Hurricane Scale*

SCALE NO. 1—Winds of 74 to 95 mph. Damage primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage to other structures. Some damage to poorly constructed signs. And/or: storm surge 4 to 5 ft above normal. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.

SCALE NO. 2—Winds of 96 to 110 mph. Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major damage to buildings. And/or: storm surge 6 to 8 ft above normal. Coastal roads and low-lying escape routes inland cut by rising water 2 to 4 hrs before arrival of hurricane center. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorages torn from moorings. Evacuation of some shoreline residences and low-lying island areas required.

SCALE NO. 3—Winds of 111 to 130 mph. Foliage torn from trees; large trees blown down. Practically all poorly constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. And/or: storm surge 9 to 12 ft above normal. Serious flooding at coast and many smaller structures near coast destroyed; larger structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hrs before hurricane center arrives. Flat terrain 5 ft or less above sea level flooded inland 8 mi or more. Evacuation of low-lying residences within several blocks of shoreline possibly required.

SCALE NO. 4—Winds of 131 to 155 mph. Shrubs and trees blown down; all signs down. Extensive damage to roofing materials, windows and doors. Complete failure of roofs on many small residences. Complete destruction of mobile homes. And/or: storm surge 13 to 18 ft above normal. Flat terrain 10 ft or less above sea level flooded inland as far as 6 mi. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hrs before hurricane center arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yds of shore possibly required, and of single-story residences on low ground within 2 mi of shore.

SCALE NO. 5—Winds greater than 155 mph. Shrubs and trees blown down; considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction of mobile homes. And/or: storm surge greater than 18 ft above normal. Major damage to lower floors of all structures less than 15 ft above sea level within 500 yds of shore. Low-lying escape routes inland cut by rising water 3 to 5 hrs before hurricane center arrives. Massive evacuation of residential areas on low ground within 5 to 10 mi of shore possibly required.

* Appears as Table 5 in Neumann, et al. (1981).

and a western barrier complex formed by a series of barrier islands and a barrier beach separated from the mainland coast by lagoons and salt marshes (Taney, 1961; Yasso and Hartman, 1975).

The headlands section, which extends 33 mi from Montauk Point westward to Southampton, has suffered severe erosion; it is classified as a glacial deposition coast (Shepard, 1973). The headlands are characterized by truncated hills of varying height and steepness fronted by a narrow beach of gravels and coarse sand. Formed by the deposition and subsequent erosion of the Ronkonkoma moraine, the headlands once extended several miles to the southeast.

Bluffed headlands are located at the shoreline between Montauk Point and Hither Hills State Park—a distance of about 10 mi. A steep cliff, 40-60 ft high has been cut into the Ronkonkoma moraine, which rises to a height of about 185 ft. The various beaches along this reach are bordered by a shallow submarine terrace.

The central portion of the headlands section from Hither Hills to Beach Hampton forms a 4 mi link between two areas of deposition of the Ronkonkoma moraine. This region is marked by a low, sandy shore with continuous coastal dunes. During severe storms, ocean waters frequently surge across this area into Napeague Harbor.

The western portion of the headlands section extends 19 mi to Southampton Village. It consists of sandy beaches fronting continuous ridges of sand dunes with elevations over 20 ft. Inland from the shore are several salt ponds—Georgica Pond, Mecox Bay, Sagaponack Lake—that have formed in glacial depressions. These depressions have been dammed by the stream of westward moving littoral material that has formed the present beach. The ponds have limited tidal connections with ocean waters.

The barrier complex section stretches approximately 73 mi from Southampton to the Nassau County/Queens boundary. This section of the Nassau-Suffolk coast has been shaped primarily by marine deposition; it is classified as a barrier coast (Shepard, 1973). At the present time, five artificially maintained tidal inlets—Shinnecock, Moriches, Fire Island, Jones and East Rockaway—break the continuity of this reach. The four barrier islands separated by the inlets—Long Beach, Jones Beach, Fire Island, Westhampton Beach—and the barrier beach at Southampton are near the northern end of the nearly continuous chain of 282 barrier islands along the Atlantic and Gulf coasts (Dolan, Hayden and Lins, 1980). These long, narrow strips of sand vary in width from less than 0.1 mi to over 1 mi in localized areas and are being remolded continually by waves, wind and currents. The ocean beach in this section varies in width from a few feet in the eastern portion to over 500 ft in some areas; the average width is between 100 and 200 ft. Sand dunes in some places rise to 30 ft in height behind the beaches. They display steep wind- and wave-eroded slopes on the seaward side and gentle slopes often stabilized by beach grass on the landward side. The barriers are separated from the mainland by interconnected tidal lagoons: Shinnecock Bay (15 mi^2), Moriches Bay (16 mi^2), and Great South Bay (111 mi^2). West of Fire Island Inlet, the Hempstead Bay system (32 mi^2) contains numerous marsh islands and tidal sloughs.

The barriers are extremely unstable, subject to drastic alteration as a result of storm events and net westward movement as a result of long-shore transport. The position and number of south shore tidal inlets have changed frequently within the historic past in part due to catastrophic storms that have cut new inlets through the barrier islands. Some of these inlets have filled naturally due to the rapid movement of large volumes of littoral drift from the east to west along the shore; others have been maintained through channel dredging and jetty construction. The westward elongation of Democrat Point at Fire Island Inlet provides a striking manifestation of the dynamic character of the barrier.

It is ironic that the relative instability of the barrier complex is the key to its long-term survival. Information on relict barrier islands on the shelf off Fire Island indicates that they have responded to submergence through the processes of in-place drowning and landward retreat. Indeed, the present barrier complex along the south shore, which formed about 7500 yrs ago, has migrated as a unit about 1.25 mi inland to keep pace with recent sea level rise since the last ice age (Sanders and Kumar, 1975). Understanding the dynamics of this coastal feature is essential in developing effective damage mitigation strategies for the barrier/lagoon complex.

2.3 SEVERE STORMS AND THEIR IMPACTS

2.3.1 Frequency of Severe Storms.* Tropical cyclones and extratropical storms (northeasters) are important agents of erosion, capable of causing significant damage along the shores of Long Island. Tropical cyclones develop over open ocean areas when surface water temperatures are above 26° to 27 °C (79° to 81 °F), usually in August, September and October, although the official tropical cyclone season is from June 1 to November 30. The counterclockwise vortex of such storms is created by winds blowing toward a low pressure central updraft; the vortex is maintained by energy from condensation of water vapor derived from the warm ocean surface. Tropical cyclones dissipate quickly as they pass over land masses or cold water because they are deprived of their source of energy (warm, moist air). The path of an individual storm is determined by its point of origin, and by the relative position and strength of low and high pressure centers located in the westerly wind belt and over the Atlantic Ocean.

Tropical cyclones range in diameter from 50-500 mi. They include tropical storms, characterized by sustained winds exceeding 34 knots (39 mph); hurricanes, characterized by sustained winds greater than or equal to 64 knots (74 mph); and great hurricanes, characterized by sustained winds exceeding 108 knots (124 mph). The area of high winds, and hence damage potential and concern associated with such storms, is typically a 75 nautical mile (86.3 mi) circle (Neumann and Pryslak, 1981).

Northeasters are much larger storms than tropical cyclones, including hurricanes, and occur much more frequently. They develop in mid-latitudes in the fall, winter and spring in response to the interaction of warm and cool air masses along a weather front. They may be more than 1000 mi in diameter—two or three times the size of a tropical cyclone. Northeasters also form a counterclockwise spiral directed toward a center of low barometric pressure, but the winds are of lower velocity than tropical cyclone winds. Some gusts of hurricane velocity do occur with northeasters. Wind direction at a particular area and time depends on the location of the storm center.

* Sections 2.3.1, 2.3.2 and 2.3.4 are based on Davies (1972); the material has been updated as required.

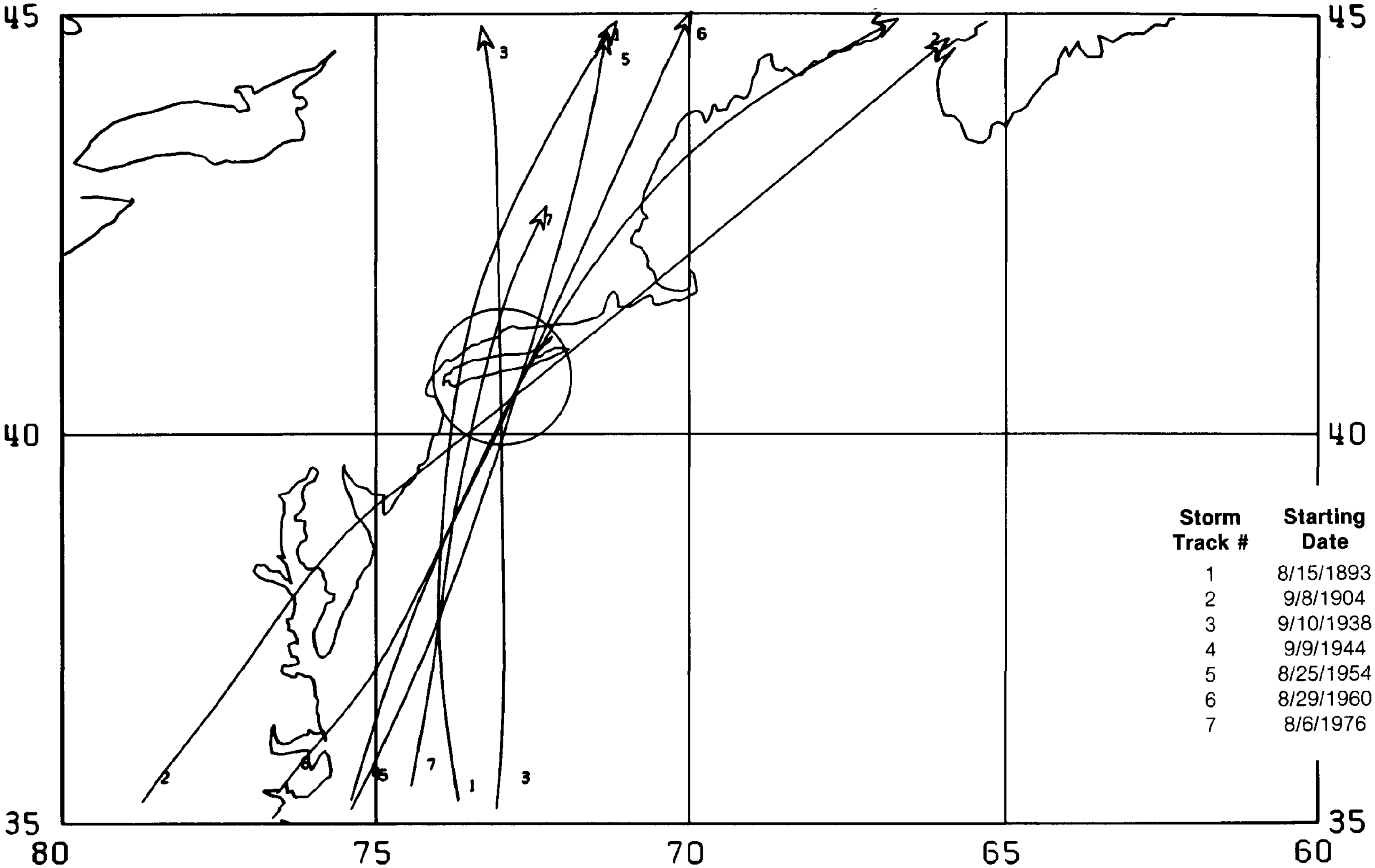
Three schemes for expressing storm frequency are contained in this report. One deals with the frequency of tropical cyclones in coastal grids that include Long Island. The frequency of northeasters causing shoreline damage in the coastal waters of New York is assessed in the second scheme. The third scheme combines the occurrence of both tropical cyclones and extratropical storms that have caused some degree of damage in shoreline areas.

2.3.1.1 Tropical Cyclone Frequency. National Weather Service data indicate that 815 tropical cyclones have occurred in the Atlantic area during the period 1886-1983 (Jarvinen and Caso, 1978).**The landfall of these storms in the Long Island area is not an uncommon event, though the frequency here is smaller as compared to that of the Gulf Coast states. Fig. 2-11 shows the tracks of the seven hurricanes passing within a circle of 50 nautical mi radius centered at 40.7 °N, 73.0°W during the period 1886-1982. During this same period, 15 tropical storms have hit the area; the tracks of all tropical cyclones (including hurricanes) are shown in Fig. 2-12. Table 2-2 describes some of the severe tropical cyclones that have affected Long Island.

It should be pointed out that no tropical storms or hurricanes have hit the Long Island region during the period 1977-present; Hurricane Belle (August, 1976) was the most recent tropical cyclone to hit the Island (Neumann, et al., 1981).

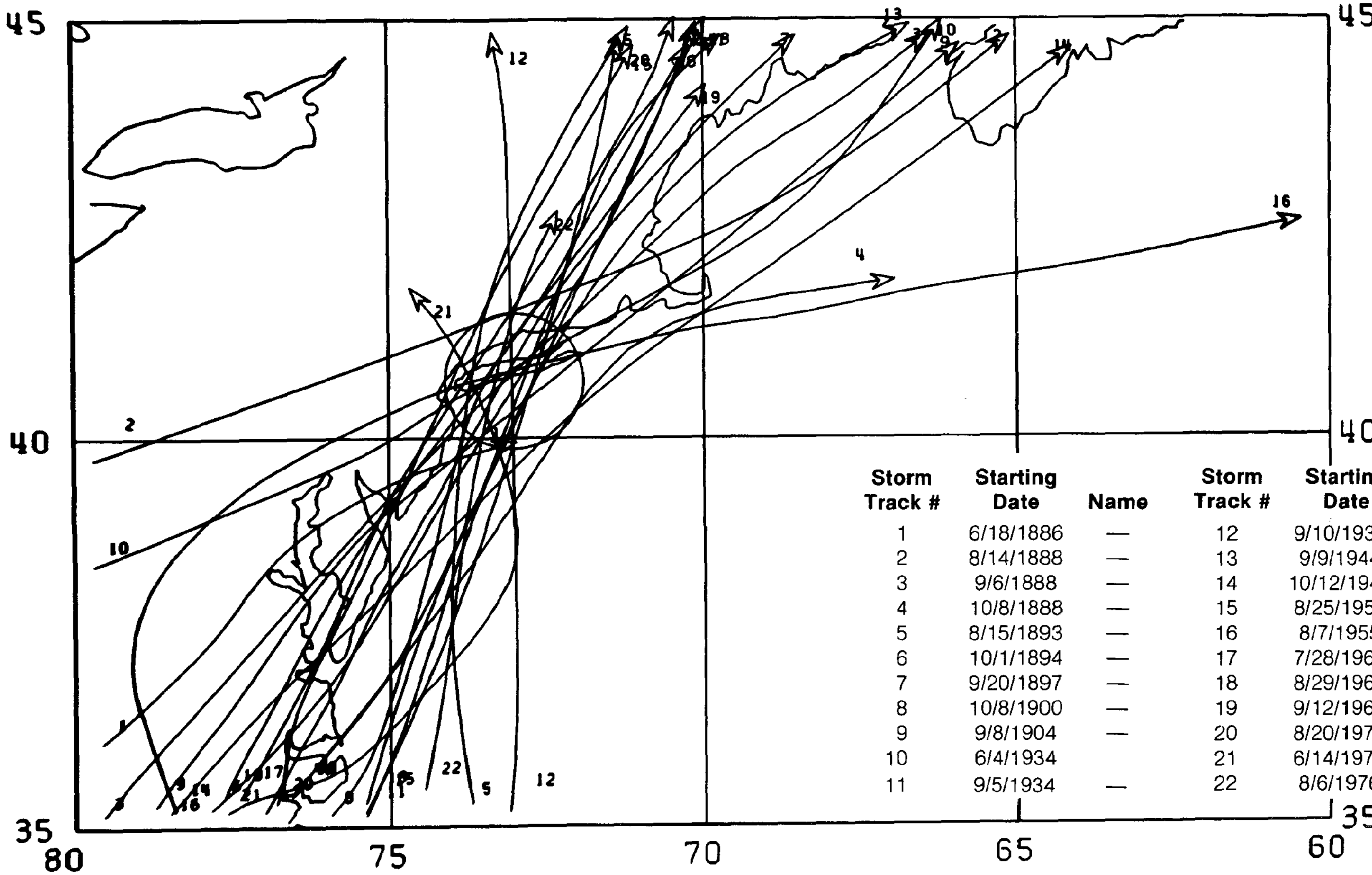
Utilizing statistical data on the motion of tropical storms in the Atlantic area, Neumann and Pryslak (1981) calculated the expected number of tropical storms and hurricanes per 100-year period impacting locations along the U.S. coastline. Fig. 2-13 shows the grids used that encompass the Long Island area. The data in Fig. 2-13 show that tropical storm occurrence in Grid 518, which includes the eastern portion of Long Island, is greater than that in Grid 517, which includes western Suffolk and Nassau County. Based on actual tropical storm occurrence and movement data, the expected number of tropical storms entering Grid 518 per 100 years is 31; 16 of these storms would be hurricanes. In Grid 517, 19 tropical storms per 100 years would be expected, of which seven would be hurricanes.

** An update of the HURDAT (HURricane DATa) data set was provided by Dr. Charles J. Neumann, Chief, Research & Development Unit, National Hurricane Center, Coral Gables, Florida.



Storm Track #	Starting Date	Name
1	8/15/1893	—
2	9/8/1904	—
3	9/10/1938	—
4	9/9/1944	—
5	8/25/1954	Carol
6	8/29/1960	Donna
7	8/6/1976	Belle

Figure 2-11
Hurricanes passing within 50 nautical miles of Long Island, N.Y. 40.7°N. 73.0°W. 1886-1982.



Storm Track #	Starting Date	Name	Storm Track #	Starting Date	Name
1	6/18/1886	—	12	9/10/1938	—
2	8/14/1888	—	13	9/9/1944	—
3	9/6/1888	—	14	10/12/1944	—
4	10/8/1888	—	15	8/25/1954	Carol
5	8/15/1893	—	16	8/7/1955	Diane
6	10/1/1894	—	17	7/28/1960	Brenda
7	9/20/1897	—	18	8/29/1960	Donna
8	10/8/1900	—	19	9/12/1961	—
9	9/8/1904	—	20	8/20/1971	Doria
10	6/4/1934		21	6/14/1972	Agnes
11	9/5/1934	—	22	8/6/1976	Belle

Figure 2-12
Tropical storms and hurricanes passing within 50 nautical miles of Long Island, N.Y. 40.7°N. 73.0°W. 1886-1982

TABLE 2-2

Selected Tropical Cyclones, Long Island

Date	Comments
August 15, 1635	Probably the first hurricane historically recorded in New England. The high tides of this storm (14 ft above high tide of Narragansett Bay, R.I.) undoubtedly had major effects on Long Island.[a]
September 22-23, 1815	The *Great September Gale of 1815* caused a great deal of damage to shorefront structures.[b] The south shore dunes were flattened, many homes and barns sustained damage.
September 3, 1821	This storm crossed Long Island in the vicinity of Jamaica Bay, causing much damage. Twenty-one lives were lost.[a, c]
September 21, 1938	Severe damage was incurred in most coastal areas; flooding was the major cause of damage. Approximately 35,000 acres were inundated between Fire Island Inlet and Montauk Point. Wave heights averaged between 10 to 12 ft along the south shore. A maximum wind speed of 96 mph was recorded on the east end of Long Island. Rainfall for the period from September 17th to 21st totalled 11.3 in., including 4.2 in. on the last day. Total physical damage along the south shore, from Jones Inlet to Montauk Point totalled over $6 million (1938 prices).[d]
September 14, 1944	Winds gusting up to 108 mph were reported at Block Island. High water, reported to be 9.2 ft above mean sea level at Manhasset and 7.9 ft above msl at the Lake Montauk.[e] $100,000 worth of damage was incurred in Westhampton Beach.[d] Damages to the North Shore and Eastern Forks totalled $733,000.[f]
August 31, 1954	Hurricane Carol caused 14 ft waves and winds up to 125 mph. Damages in Nassau and Suffolk Counties totalled approximately $3 million. 275,000 Long Island homes were left without electricity.[g] Three in. of rain fell the last day of the storm at Setauket. Suffolk County was declared a major disaster area by President Eisenhower on 9/2/54.[g]
September 12, 1960	Hurricane Donna necessitated the evacuation of several hundred families from low-lying areas between Amityville and Babylon. A total of $1.9 million worth of damage was incurred in areas from Jones Inlet to Montauk Point. Four to five thousand people were evacuated from the barrier beach to the mainland.[f]
August 9-10, 1976	Hurricane Belle struck on a falling tide, lessening water damage. Sea level at Montauk was only about 3 ft above the predicted tide. Little coastal flooding and damage were reported.[h] However, the storm caused significant damage to vegetation by wind-driven salt spray.

[a] Ludlum, D. 1963. Early American hurricanes, 1492-1870. American Meteorological Society, Boston.

[b] Tannehill, I.R. Hurricane of September 16 to 22, 1938. Monthly Weather Review 66:286-88.

[c] U.S. Army Engineer District, New York. 1958. Atlantic coast of Long Island, N.Y.: cooperative beach erosion control and interim hurricane study (survey). Appendix G: History of storms. Serial No. 69. P. G. 6.

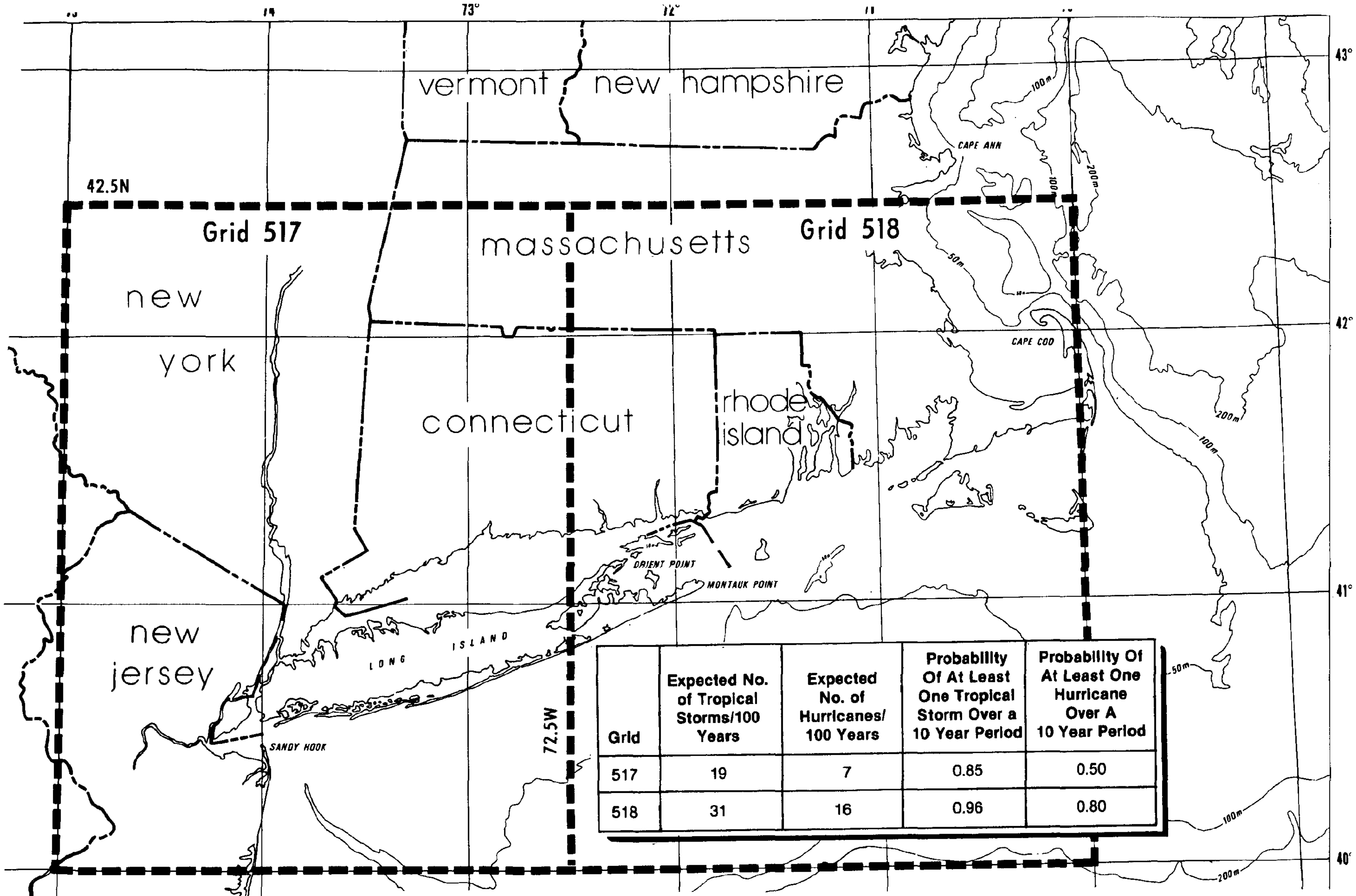
[d] Chief of Engineers, Department of the Army. 1967. Jones Inlet to Montauk Point, New York (remaining areas). House Document No. 191.

[e] Pore, N.A. and C.S. Barrientos. 1976. Storm surge. MESA, New York Bight Atlas Monograph 6. New York Sea Grant Institute, Albany, New York.

[f] U.S. Army Corps of Engineers. 1969. North shore of Long Island, Suffolk County, New York, beach erosion control and interim hurricane study. New York District, U.S. Army Corps of Engineers, New York.

[g] Newsday, 1 September 1954, p. 2.

[h] Eisel, M.T. 1977. A shoreline survey: Great Peconic, Little Peconic, Gardiners and Napeague Bays. Marine Sciences Research Center, SUNY. Special Report 5.



Grid	Expected No. of Tropical Storms/100 Years	Expected No. of Hurricanes/ 100 Years	Probability Of At Least One Tropical Storm Over a 10 Year Period	Probability Of At Least One Hurricane Over A 10 Year Period
517	19	7	0.85	0.50
518	31	16	0.96	0.80

Figure 2-13
Expected number of tropical storms and hurricanes per 100 years impacting the Long Island region.

Using the Poisson distribution function as illustrated in Neumann and Pryslak (1981), the probability of a certain number of storms passing through an area over a given time interval can be calculated. Fig. 2-13 shows the result of such calculations for Grids 517 and 518. Probability values range from 0.0 to 1.0. (A probability of 0.0 indicates that there is no chance of an event occurring; a probability of 1.0 indicates that the event is certain.) The probability that at least one tropical storm will impact the Long Island area over the next 10 years ranges from 0.85 to 0.96; this indicates that it is very likely that such an event will occur in the next decade. The probabilities that at least one hurricane will impact this area over the next 10 years are slightly less, ranging from 0.50 to 0.80. They also indicate that such an event is likely. If a time period longer than 10 years is used in the calculation, the probabilities would be even higher.

2.3.1.2 Frequency of Northeasters Causing Shoreline Damage. In a study of northeasters affecting the Atlantic coastal margin of the United States during the period 1921-1962, Mather, Adams, and Yoshioka (1965) found that during the 42 year period of record, 34 extratropical storm events occurred that resulted in water-related damage, i.e., damage due to wave action and tidal flooding, in the coastal areas of New York. The recurrence interval of such storm events is 1.24 yrs. Stated in another way, a storm of this nature has an 81% chance of occurrence in a given year, based on the observed data. Selected extratropical storm events that have impacted Long Island are described in Table 2-3. The northeaster of March 28-30, 1984 resulted in a Presidential Declaration of Disaster in Nassau and Suffolk Counties.

2.3.1.3 Frequency of Both Tropical Cyclones and Northeasters Causing Shoreline Damage. The U.S. Army Corps of Engineers (1969) has reviewed literature on storms that have affected the segment of shoreline from central Maryland north to the New Hampshire-Massachusetts state boundary. Storms passing through this region were believed to have caused either some degree of shoreline damage on Long Island, or at least threatened the area. The storms were classified as hurricanes, extratropical storms and tropical storms. Categories were assigned to the storms on the basis of damage they inflicted on Long Island shore areas as follows:

Category

A— unusually severe damage
B— severe damage
C— moderate damage
D— threatened area (no damage)

During the period 1635-1962 a total of 231 storms either threatened or did some degree of damage to the Long Island shore areas. Table 2-4 summarizes the Corps data on storm occurrence.

A total of only 27 storms of all types were recorded during the time period 1635 to 1800. Storm data during this time period are incomplete; however, the occurrence of storms that produced severe damage (Category **A**) has probably been well documented. Based on the 204 storms which occurred during the period 1800-1962, the Long Island area experiences a storm which causes moderate damage about once every two years. Unusually severe storms should occur, on the average, three times every century.

2.3.2 Storm Surge. Both tropical cyclones and extratropical storms produce storm surges, defined as the *difference between the observed water level and that which would have been expected at the same place in the absence of the storm* (Harris, 1963: 2). The height of the surge associated with a particular storm depends, in part, on the following four processes:

1. *The inverted barometer effect.* The sea level surface is elevated in response to the low pressures associated with storms. In the open ocean, a pressure drop of 33.86 millibars of mercury (one in.) will lead theoretically to a 13 in. rise in sea surface elevation (Hobbs, 1970).
2. *Wind set-up.* Wind stress on the water surface will cause water levels to increase along the fetch in a downwind direction. Wind stress, and hence, wind set-up are proportional to the square of the wind velocity. Wind set-up is also enhanced by decreasing depth (Harris, 1963).
3. *Wave set-up.* Breaking waves transport water into the near-shore zone, thus leading to increased height of the water level surface in this area. Wave set-up may account for as much as 3.2 to 6.4 ft of storm surge

TABLE 2-3
Selected Northeasters, Long Island

Date	Comments
March 11-14, 1888	The high winds of the *Blizzard of '88* created snow drifts 10-12 ft high in the Long Island Sound area. Over 44 in. of snow fell in New Haven.[a]
October 24-25, 1897	Tidal flooding separated Orient Village from the rest of the North Fork.[b]
November 25, 1950	At Brookhaven Laboratory, sustaining winds of 73 mph and gusts up to 93 mph were reported. Sixteen breaks occurred in the Westhampton barrier bar. Roughly $1.75 million in damages occurred along the North Shore and the Peconics.[b] The U.S. Coast Guard reported waves reaching 20 ft in the vicinity of Jones Inlet.[c]
November 6-7, 1953	Average wind speeds at Block Island were recorded at 75 mph, with gusts reaching 95 mph. Estimated wave heights along the south shore of Long Island were approximately 20 ft. Total damage to the barrier beach between Jones and Fire Island Inlets was approximately $600,000. Damage in the inner bay areas, including damage to the barrier island east of Fire Island Inlet, totaled $1.1 million (1953 prices).[c]
March 6-8, 1962	Extensive damage occurred to the barrier beach and inner bay communities of the south shore. Strong east winds and fetch lengths of 1,000 mi created ocean waves 20 to 30 ft high. Total damage to the south shore from Jones Inlet to Montauk Point was estimated at $16,549,000. On March 16th, President Kennedy declared coastal sections of N.Y.C. and Long Island a disaster area.[c, d] This storm caused 50 washovers between Fire Island Inlet and Southampton.
February 6-8, 1978	The heaviest snow storm since December 26, 1947[e] dropped 12 in. of snow on Montauk Point, 22 in. on Long Beach, and 23 in. at Islip-MacArthur Airport.[f] The Orient Point Causeway was under 2 ft of water while the south shore was battered by 15 ft waves.[e] Six Fire Island homes collapsed and 60 more were endangered. South shore home damages totalled over $1 million. Three storm-related deaths were reported in Nassau and Suffolk Counties.[f]
March 28-30, 1984	This large storm, accompanied by gale force winds and wind-driven waves up to 20 ft high, had a central pressure of 28.5 in. Nassau and Suffolk Counties were declared disaster areas by President Reagan on April 17, 1984. Tides at Willets Pt. were 5.5 ft above normal at high tide. Beaches and dunes suffered severe erosion and shoreline protection structures were damaged, as were public recreational facilities along the south shore. Residential structures were impacted by extensive basement flooding.[g]

[a] Brumbach, J.J. 1965. The climate of Connecticut. State Geological and Natural History Survey of Connecticut. New Haven. Bull. 99.
[b] U.S. Army Corps of Engineers. 1969. North shore of Long Island, Suffolk County, New York, beach erosion control and interim hurricane study. New York District, U.S. Army Corps of Engineers, New York.
[c] Chief of Engineers, Department of the Army. 1967. Jones Inlet to Montauk Point, New York (remaining areas). House Document No. 191.
[d] U.S. Weather Bureau. East coastal Atlantic storm. Shore and Beach. 30 (1962): 4-10.
[e] Newsday, 7 February 1978.
[f] Newsday, 8 February 1978.
[g] Region II Hazard Mitigation Team. 1984. Interagency hazard mitigation report in response to the April 17, 1984 disaster declaration, State of New York. FEMA, Region II, N.Y.

TABLE 2-4

History Of Storm Occurrences, Long Island Region*

Category	Storm Type	Occurrences in Time Interval 1635-1962	1800-1962	1885-1962	Recurrence Interval By Category (years) 1800-1962	1885-1962
Unusually Severe (A)	Hurricane	8	5	2		
	Tropical storm	—	—	—		
	Extratropical	—	—	—	32.4	38.5
	Unknown	1	—	—		
	Total	9	5	2		
Severe (B)	Hurricane	9	7	6		
	Tropical storm	—	—	—		
	Extratropical	4	4	3	13.5	8.5
	Unknown	3	1	—		
	Total	16	12	9		
Moderate (C)	Hurricane	41	35	23		
	Tropical storm	3	2	2		
	Extratropical	35	35	37	2.1	1.2
	Unknown	8	5	1		
	Total	87	77	63		
Threatened the area (D)	Hurricane	46	41	31		
	Tropical storm	24	23	21		
	Extratropical	39	39	41	1.5	0.8
	Unknown	10	7	1		
	Total	119	110	94		
Total	Hurricane	104	88	62		
	Tropical storm	27	25	23		
	Extratropical	78	78	81		
	Unknown	22	13	2		
		231	204	168		

* Appears as Table 7 in Davies (1972).

height at a beach (Gentry, 1966). This effect is maximized by waves which break parallel to the coast (Harris, 1963).

4. *Rainfall effect.* Intense rainfall can lead to an increase of water levels, especially in estuaries.

Shoreline configuration plays an important role in modifying storm surge. In general, configurations which favor an increase in the range of astronomical tide will also favor an increase of storm surge heights.

Shoreline damage and erosion are often related to the maximum tides produced by a storm. Factors which determine the magnitude of storm surge in relation to mean high water are the stage of the astronomical tide, the intensity of the storm, the speed of storm movement, and the angle of the storm track at the shoreline (Hobbs, 1970). Tropical cyclones and northeasters produce different effects with regard to the latter three factors.

The strongest winds in tropical cyclones are located in a narrow band surrounding the center, or eye, of the storm (Tannehill, 1950). The barometric pressure of the eye is a good indicator of storm intensity (Harris, 1966); indeed, empirical relationships suggest that hurricane central pressure is the dominant factor determining storm surge (Hoover, 1957). Storm surge peaks and maximum wind velocities, however, are not found at the eye of the storm, but are displaced into the region to the right of the storm track.

The wind pattern of tropical cyclones consists of a counterclockwise spiral. The winds in the right quadrants of this spiral are more or less parallel with, and reinforced by, the translational movement of the storm. This reinforcement can be of considerable magnitude, as hurricanes have travelled at forward speeds of over 50 knots. Wind and wave set-up are at a maximum in the right, or dangerous half of tropical cyclones (Hall, 1939). *South-facing coasts like Long Island's south shore,* that are aligned perpendicular to storm tracks, receive the full impact of the reinforced winds and wave set-up. North-facing coasts are somewhat protected. If the storm track passes to the right of a coast, wind and waves will be directed in an offshore direction, thus minimizing shore damage due to tidal flooding (Hobbs, 1970). The winds to the left of the storm track are also weaker than those to the right, in that the winds blow in directions opposite to the translational movement of the storm.

Review of the storm tracks of major damage-producing hurricanes in the Long Island region, shown in Fig. 2-11, confirms the dominant effect of shoreline orientation on storm surge. The hurricanes of September 21, 1938 and August 31, 1954 travelled in paths #3 and #5 in Fig. 2-11 perpendicular to the shoreline, and caused record tides at many Long Island locations.

In general, fast moving tropical cyclones have peak storm surges that are higher than slower moving storms. However, if there is no over-topping of a barrier island, for example, *a slower moving storm will cause a higher surge in bay areas than a faster moving storm.* In this instance, there is more time for water to flow into bays via tidal inlets. However, if barrier over-topping occurs, the faster moving storm will cause higher surges in the bays as compared to a slower moving storm. The problems of hurricane forecasting and adequate evacuation are exacerbated in the Long Island area by the fact that hurricanes travel at faster speeds in the North Atlantic region, as compared to the Gulf and South Atlantic coasts.

Extratropical cyclones are about three times as large as tropical cyclones (Byers, 1959). The pressure gradients, and hence, wind velocities of extratropical storms are lower than those associated with tropical cyclones. Gusts of hurricane velocity, however, have been associated with northeasters (Brumbach, 1965). Wind patterns of northeasters form a counterclockwise spiral directed toward the center of low barometric pressure. Wind directions from such storms at a particular area depend on the relative position of the storm track (Zeigler, Hayes, and Tuttle, 1959). When a storm center passes to the west of Long Island, winds blow initially from the east or southeast. As storm movement progresses, the winds shift to south and then west. This type of storm results in offshore winds for the north shore of Long Island, and onshore winds for the south shore. If, on the other hand, the storm center passes to the east of Long Island, the initial winds will blow from the northeast. Later, the winds will veer to the north and northwest. This type of storm produces onshore winds along the north shore, leading to increased wave height and wind set-up along this area. Offshore winds on the south shore would reduce wave height along this coast.

The effect of northeasters on shoreline areas often depends on their speed of forward movement. If the storm progresses rapidly, variable wind directions over a given fetch length prevent the buildup of large storm waves. However, if storm progress is delayed by ridges of high pressure, winds from a particular direction have time enough to act on a given wave group, to produce waves of maximum height for a specific wind velocity and fetch (Burt, 1958; Darrielsen, Burt and Rattray, 1957). The wave heights on an open coast produced by a stationary northeaster of sufficient intensity may equal or exceed those produced by many tropical cyclones. Those storms with easterly winds of long duration have the greatest effect on the Island's south shore.

The severe winds and extreme tides of tropical cyclones usually last less than six hours (Gentry, 1966). The wind and wave effects of extratropical cyclones, though perhaps less severe, can last up to four or five tidal cycles. Prolonged attack during successive high tides on an eroding beach can lead to substantial dune and bluff recession (Hayes and Boothroyd, 1969), and damage to shoreline development. Such a situation occurred when the March 6-8, 1962 northeast storm caused abnormally high water levels on five successive high tides. Figs. 2-14 and 2-15 show damage to structures on Fire Island caused by this storm. The long duration of northeasters can result in higher flood levels in bay areas than those associated with hurricanes producing the same surge peak elevations in open ocean waters (Balloffet and Scheffler, 1980). Urbanization and wetland destruction through landfill has also been shown to significantly increase the areal extent of surge flooding along bay shorelines. Fig. 2-16 shows a breach of the barrier beach at Westhampton Beach and its destruction.

2.3.2.1 Storm Surges of Major Storms. The south shore of Long Island has been impacted by five major storms in the past 50 years. These storms caused serious coastal flooding in many communities. The 1938 hurricane damaged or destroyed 1000 Fire Island homes and 45 lives were lost in Nassau and Suffolk Counties (U.S. Dept. of Interior, 1977). The November 25, 1950 northeast storm caused 16 breaks in the Westhampton barrier bar; 20 ft waves were recorded at Jones Inlet (U.S. Army Corps. of Engineers, 1969). In 1954, hurricane Carol packed winds up to 125 mph and waves of 14 ft; the severity of the damage warranted the declaration of Suffolk County as a major disaster area.

Figure 2-14
Point O' Woods, Fire Island–
Destruction resulting from Northeast storm of March 6-8, 1962
Photo–courtesy Newsday

Figure 2-15
Fire Island–
Property damage after Northeast storm of March 6-8, 1962

Hurricane Donna prompted the evacuation of the low-lying areas of Amityville and Babylon, as well as thousands of people from the barrier beach in 1960 (U.S. Army Corps of Engineers, 1969). The March 1962 northeast storm caused ocean waves of 20 to 30 ft; $16 million in damages were incurred from Jones to Fire Island Inlets; and coastal sections of Long Island were declared disaster areas (U.S. Army Corps of Engineers, 1969).

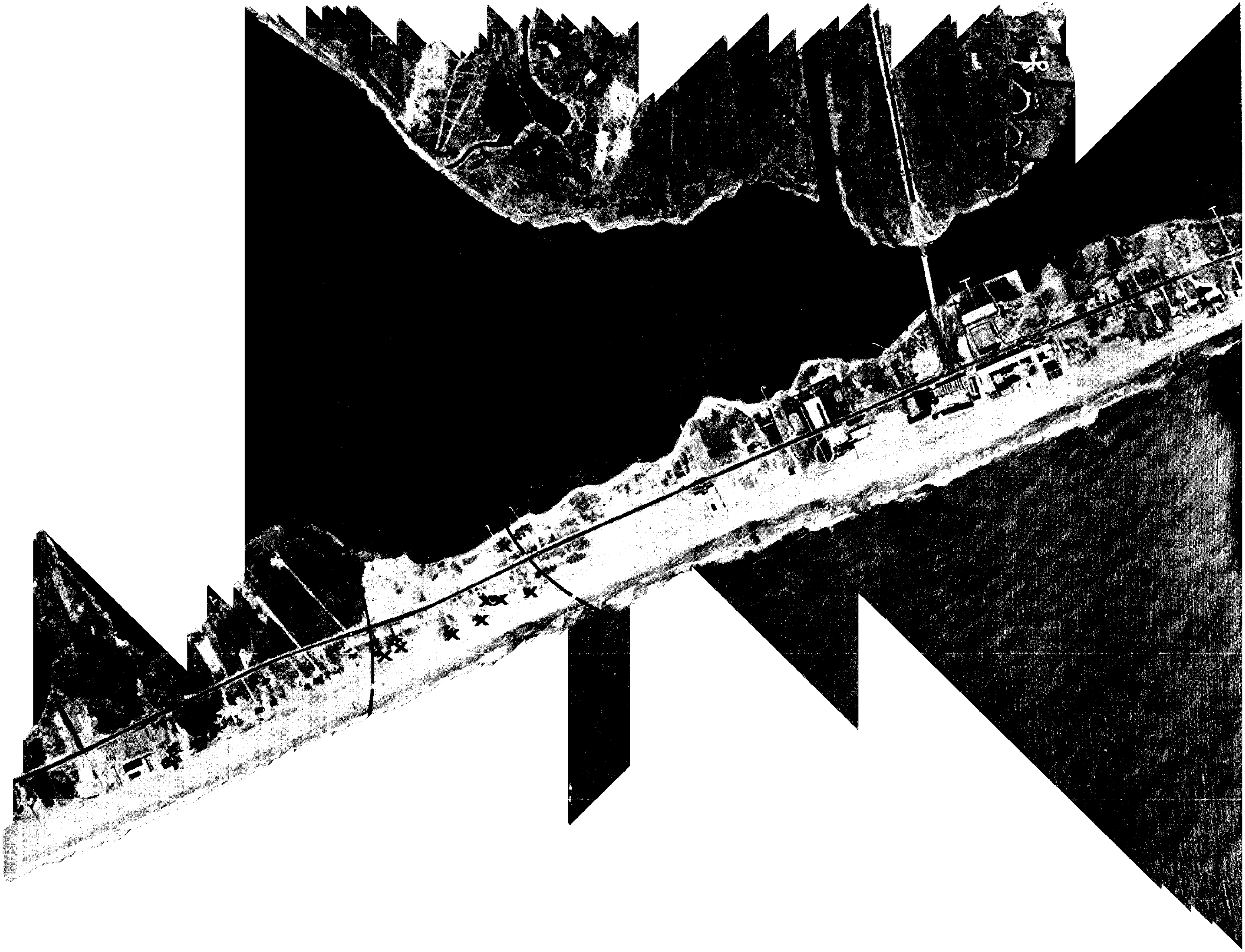
Most of the damage caused by these storms was due to the storm surge in many coastal locations. Figures 2-17 thru 2-21 display the flood elevations experienced by south shore locations during each of the five storms. Each figure shows the general location of the measurement and the height of flood waters above the *National Geodetic Vertical Datum* (NGVD) during each storm event (Topo-Metrics, Inc. undated).

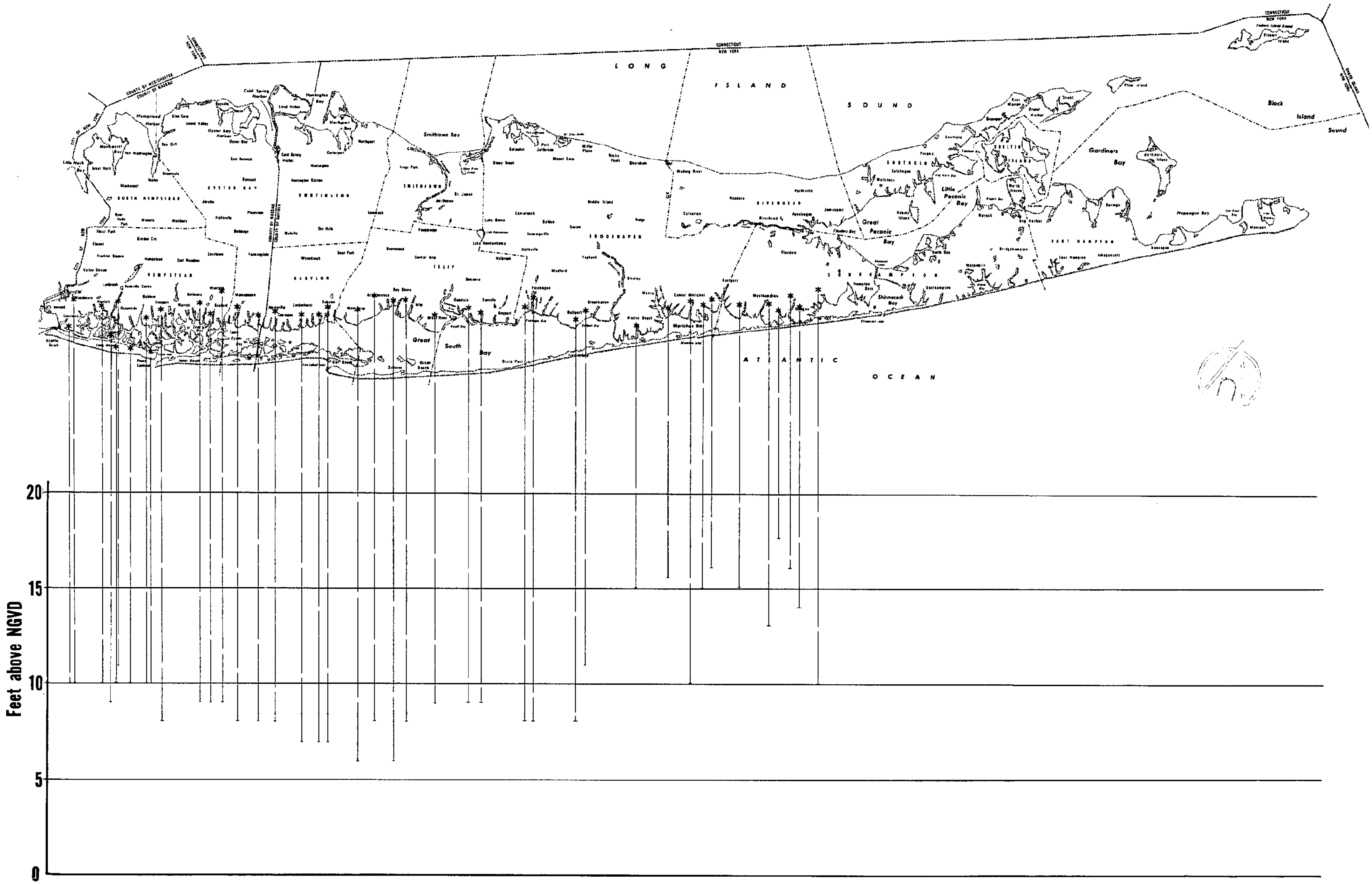
Figure 2-16
Aerial photo prior to March 6-8 1962. Northeast storm showing location of a breach in the barrier island and the structures destroyed.

The corresponding oblique aerial photo shows an eastward view of the breach caused by the storm

NOTE:
Structures marked by a red "x" indicate destroyed.

(Oblique photo courtesy of the U.S. Army Corps of Engineers)



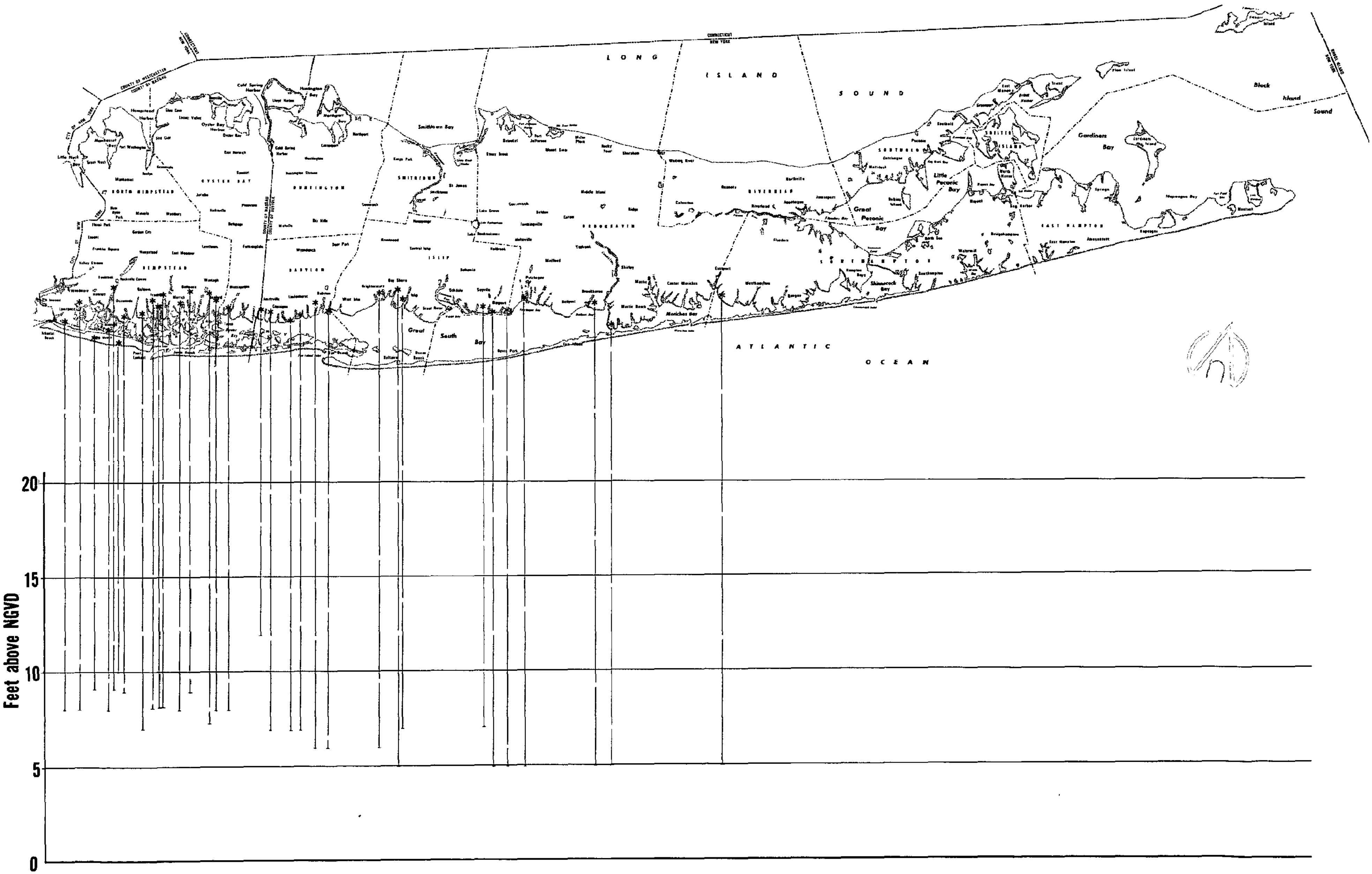


National Geodetic Vertical Datum (NGVD) Level — 0

Figure 2—17

STORM FLOOD ELEVATIONS

(Hurricane - 21 September 1938)



National Geodetic Vertical Datum (NGVD) Level — 0

Figure 2–18

STORM FLOOD ELEVATIONS

(Northeaster - 25 November 1950)

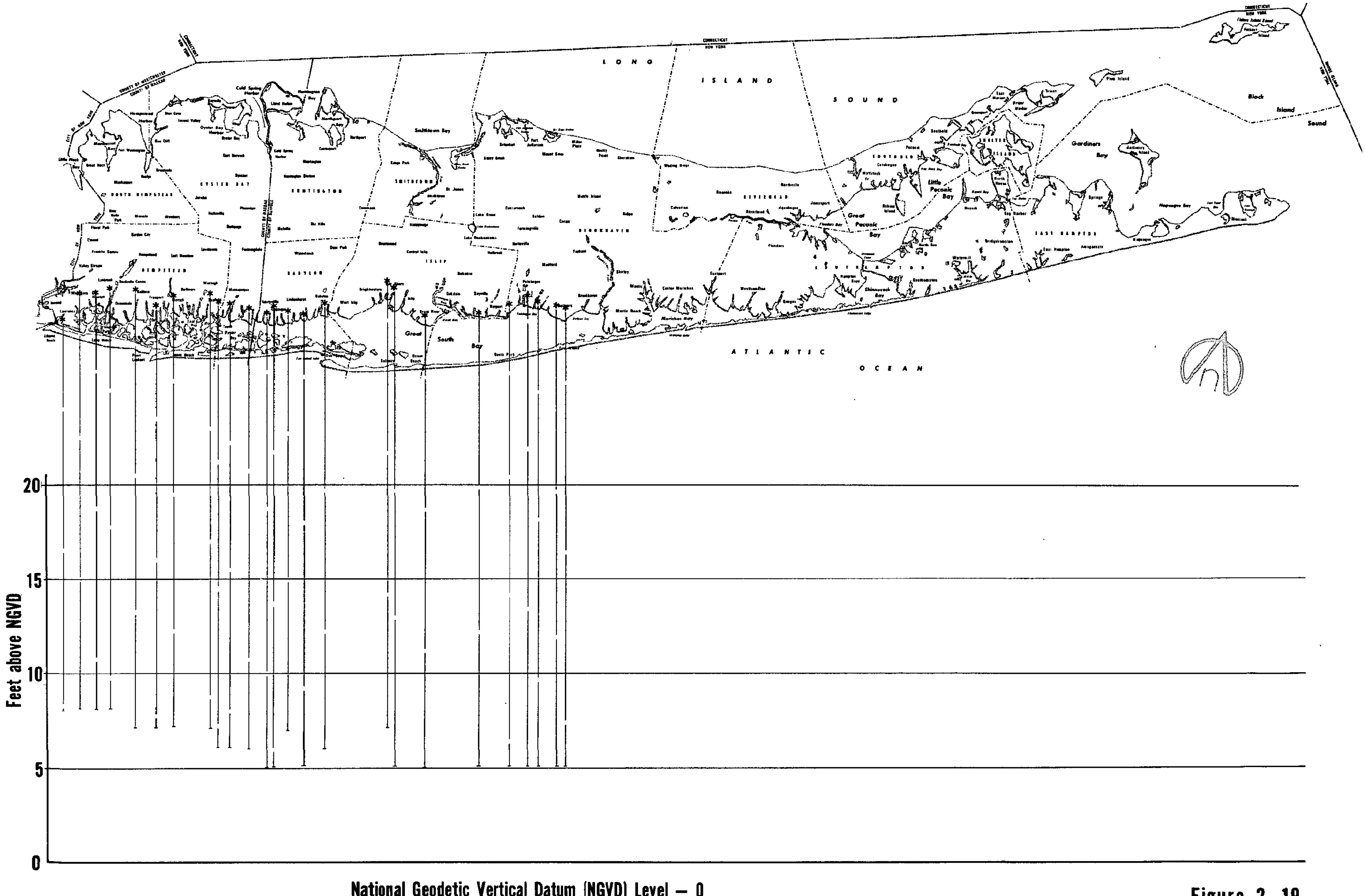
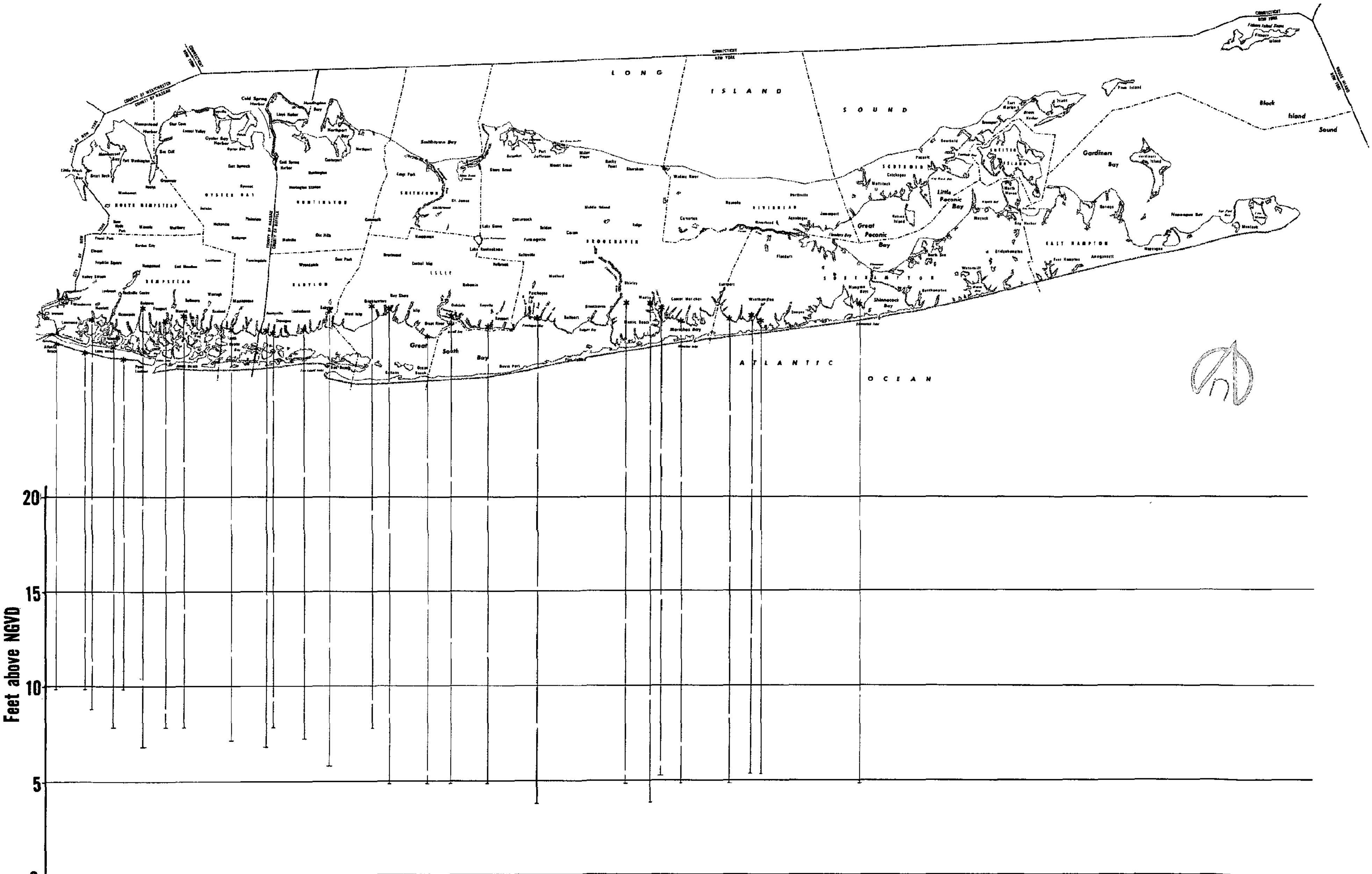


Figure 2–19

STORM FLOOD ELEVATIONS

(Hurricane Carol - 31 August 1954)

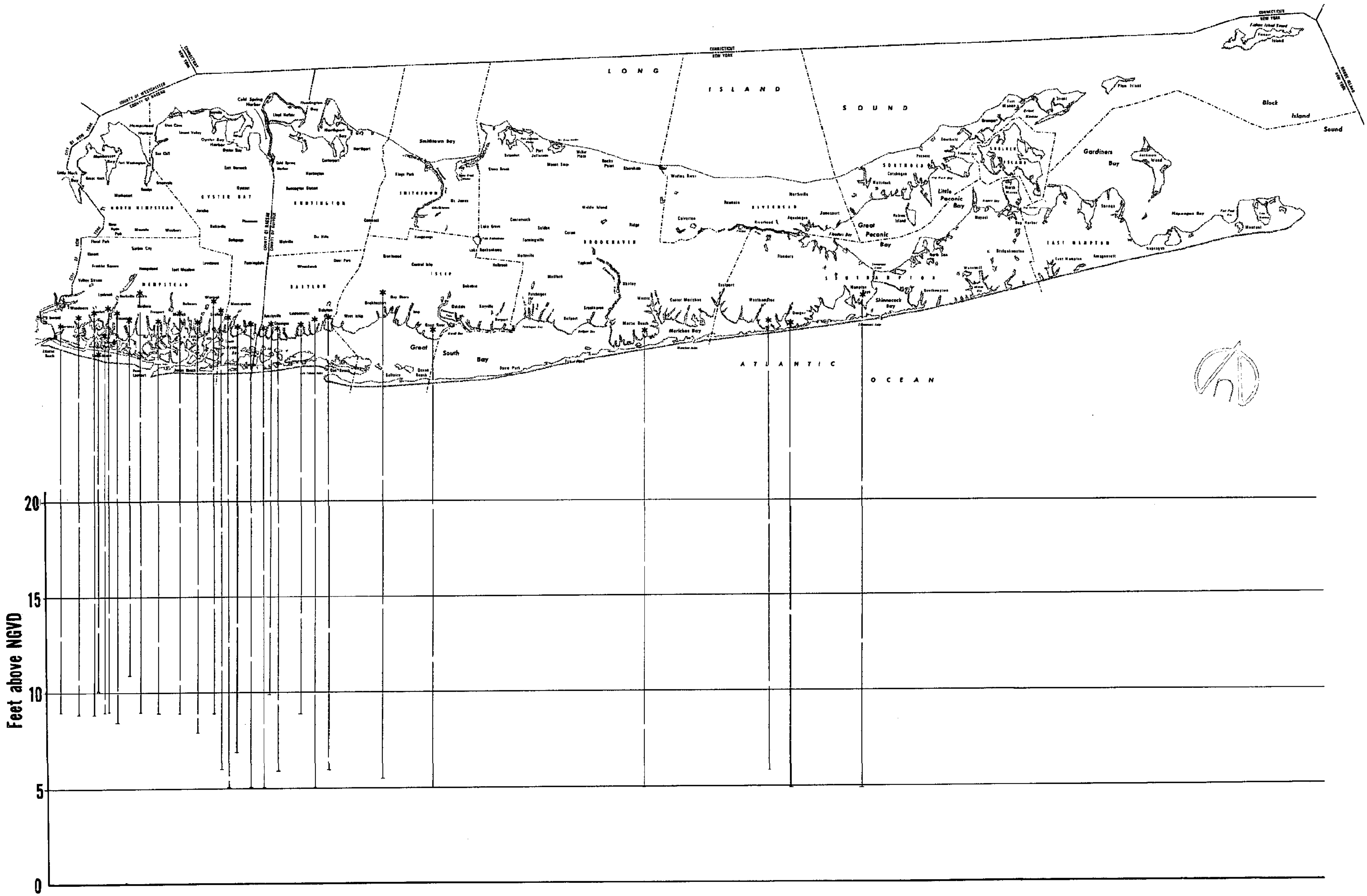


National Geodetic Vertical Datum (NGVD) Level – 0

Figure 2–20

STORM FLOOD ELEVATIONS

(Hurricane Donna - 12 September 1960)



National Geodetic Vertical Datum (NGVD) Level – 0

Figure 2–21

STORM FLOOD ELEVATIONS

(Northeaster - 6-8 March 1962)

The highest flood elevations in the 1938 hurricane (Fig.2-17) occurred in the eastern portion of Suffolk County. The flood height observations range from 6 ft above NGVD in Bay Shore and West Islip to 17.5 ft above NGVD in Westhampton Beach. In the hardest hit community, photographs of watermarks on buildings indicate that flood waters were 6 ft above the sidewalk on Main Street, Westhampton Beach.

The flood elevations associated with the Northeast storm of November 25, 1950 are shown in Fig. 2-18. Generally, the highest flood elevations were recorded in Nassau County. The flood heights range from 5 ft above NGVD in Islip to 12 ft above NGVD in Amityville. The City of Long Beach also experienced severe flooding. With flood elevations 10 ft above NGVD, the area surrounding Long Beach Hospital was under 2 ft of water.

In 1954, Hurricane Carol (Fig. 2-19) flooded many south shore communities. The flood elevations ranged from 5 ft in the Sayville-Patchogue areas to 8 ft above NGVD in East Rockaway. The flooding was most severe in Nassau County.

Fig. 2-20 depicts the flood levels associated with Hurricane Donna. The south shore communities of Nassau County experienced the highest flood elevations. Areas in Atlantic Beach and Long Beach recorded flood elevations of 10 ft. The barrier beach was breached at Lido Beach. The lowest flood elevation was observed to be 4 ft above NGVD at Mastic.

The northeast storm of March 6-8, 1962 (Fig. 2-21) caused flooding which ranged from 11 ft at Oceanside to 5 ft above NGVD in the Massapequa area. South shore communities of Nassau and western Suffolk Counties experienced the highest flood elevations.

2.3.3 Storm Floods and Flood Insurance Rate Maps. *Flood Insurance Rate Maps* (FIRMs) show mathematically projected storm tide elevations with recurrence intervals of 100 and 500 years. The FIRMs identify zones of varying flood hazard which exist within the 100-year, and 500-year floodplain areas. The **V** and **A** zones comprise the 100-year flood area, and the 500-year floodplain contains the **B** zone as well as the **V** and **A** zones. Areas prone to experiencing a 100-year flood have been cited by the Federal Emergency Management Agency (FEMA) as areas appropriate for floodplain management and the application of developmental controls. In compliance with FEMA regulations, the first floor and basement of new construction in **A** and **V** zones must be elevated above the level of the base flood. The base flood elevation includes the height of the 100-year stillwater storm surge and wave effects as they relate to mean sea level.

Fig. 2-22 illustrates the 100-year stillwater elevation level; the 100-year flood elevation with wave effects; the physical configuration of the land as it affects wave heights; and the location of **A** and **V** zones in a typical transect of a coastal area.* Although actual wave conditions in all coastal areas may not include all situations shown in Fig. 2-22, the schematic attempts to graphically display the general conditions. The calculation of the effects of wave heights on the 100-year flood elevation involves three major concepts.

> First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions such as sand dunes, dikes and seawalls, buildings, and vegetation. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.**

Along the transect, flood elevations and wave heights for the 100-year flood were determined by the combined effects of changes in ground elevation, vegetation, and physical features. The 100-year flood area can then be divided into **A** and **V** zones. The **V** zone extends landward until the point where the flood depth is insufficient to support 3 ft breaking waves. At this point, the **A** zone begins and it continues to the edge of the 100-year flood boundary.

V and **A** zones are subdivided into Flood Insurance Zones, each having a specific flood potential or hazard. Therefore, flood insurance rates differ within each **V** zone and each **A** zone in accordance with their designation (e.g., A5, A6, V7).

* This figure is typically found in the flood insurance wave height analysis studies prepared for coastal communities by FEMA.

**These quotations are typically found in FIRM studies.

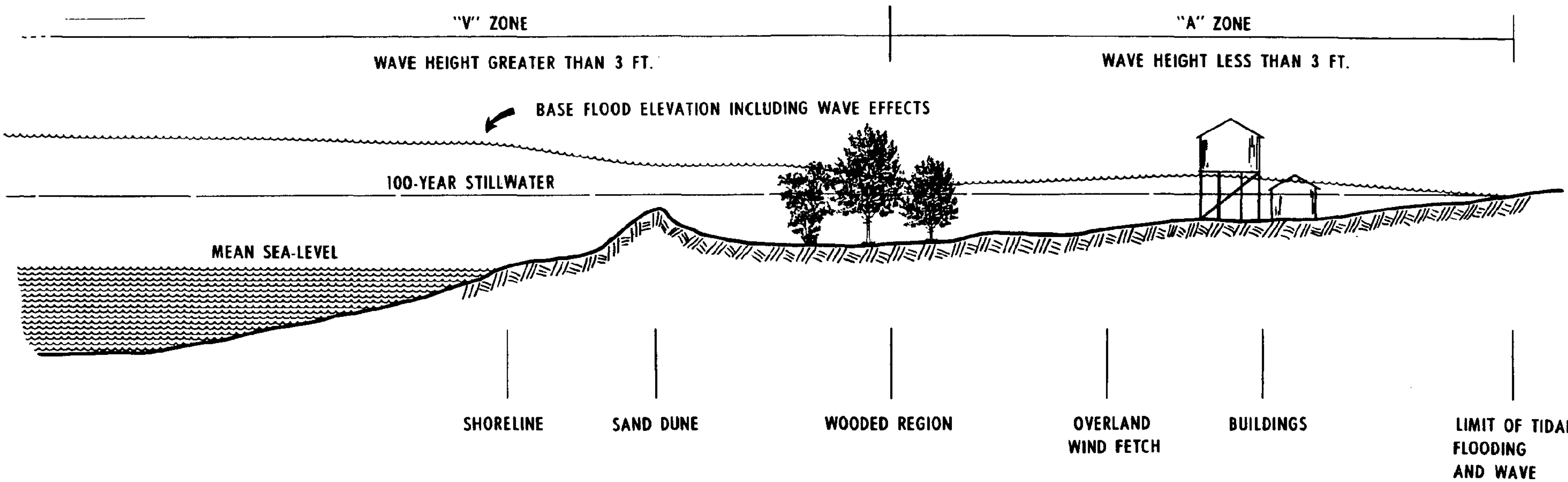


Figure 2-22
Relationship of shoreline topography and flood elevation as shown by a typical coastal transect

V zones would be most severely affected by the 100-year flood. In this zone, structures must be elevated by piles or piers above the base flood level. Basements and first floors of new construction in an **A** zone must be elevated above the level of the base flood.

The **B** zone is located between the special hazard area and the limits of the 500-year floodplain. Included in the 500-year floodplain are areas protected from the 100-year flood by control structures; also, areas subject to 100-year flooding where depths are less than 1.0 ft; and also, areas subject to 100-year flooding from sources with drainage areas less than 1 mi^2.

Table 2-5 lists the municipalities along the south shore of Long Island, their respective flood insurance zones, and the range of flood elevation in ft in each zone (shown in parentheses). Due to the relatively low hazard associated with occupancy in the **B** zone, and the fact that riverine flooding is a minor problem on Long Island, it was decided that the geographic scope of this study would be limited to the 100-year floodplain, which includes both **A** and **V** zones. In the communities of the south shore, the **A** zones range from 4 to 16 ft and the **V** zones range from 8 to 18 ft above National Geodetic Vertical Datum (NGVD). Water damage associated with flooding in **V** zones is typically more severe than that found in **A** zones, because of direct wave action impacts.

TABLE 2-5
Flood Insurance Zones For Municipalities On The South Shore Of Long Island*

Governmental Unit	Flood Insurance Zones (range of base flood elevations in ft above NGVD)
NASSAU COUNTY:	
1. Town of Hempstead	A4 (7-12) A5 (7-12) A6 (10) V4 (9-12) V6 (10) V7 (12-15)
2. Village of Atlantic Beach	A5 (7-12) V7 (12-15)
3. Village of Cedarhurst	A4 (8)
4. Village of East Rockaway	A5 (8)
5. Village of Freeport	A3 (7)
6. Village of Hewlett Bay Park	A4 (7-9)
7. Village of Hewlett Harbor	A5 (8)
8. Village of Hewlett Neck	A4 (7-8)
9. Village of Island Park	A4 (8)
10. Village of Lawrence	A5 (7-9) A4 (7-9)
11. Village of Rockville Centre	A2 (7)**
12. City of Long Beach	A5 (7-12) V7 (12-15)
13. Village of Woodsburgh	A4 (7-8)
14. Town of Oyster Bay	A7 (14) A8 (12-14) A9 (14-16) V4 (8-9) V7 (12-14) V9 (14-18) V6 (12)
15. Village of Massapequa Park	A4 (7-8)
SUFFOLK COUNTY:	
16. Town of Babylon	A4 (6-8) A5 (5-12) V4 (8-10) V7 (11-15)
17. Village of Amityville	A3 (6)
18. Village of Babylon	A3 (6)
19. Village of Lindenhurst	A3 (5)
20. Town of Islip	A4 (4-7) A5 (5-12) A6 (4-12) V7 (11-15)
21. Village of Brightwaters	A4 (4-7)
22. Village of Ocean Beach	A6 (5-12) V7 (12-15)
23. Village of Saltaire	A6 (5-12) V7 (12-14)
24. Town of Brookhaven	A4 (4-6) A4 (11) A5 (5-10) A7 (7-9) A7 (11-13) V7 (12-15) V8 (9-17) V9 (14-17)
25. Village of Bellport	A4 (4-6)
26. Village of Patchogue	A4 (4-6)
27. Town of Southampton	A5 (8-11) A6 (7-9) A7 (7-12) A8 (7-12) V7 (10-15) V8 (9-12)
28. Village of Quogue	A6 (7-9) A8 (7-9) V7 (12-15) V8 (9-12)
29. Village of Southampton	A7 (10-12) A8 (7-9) V7 (12-15) V8 (9-12)
30. Village of Westhampton Beach	A7 (7-9) A8 (7-9) V7 (12-15) Beach V8 (9-12)
31. Town of East Hampton	A7 (10-12) A8 (8-11) V7 (10-15)
32. Village of East Hampton	A7 (10-12) V7 (12-15)

* A listing of the community flood insurance studies and FIRMs used to compile this table is included at the end of the References section of this chapter.

** Wave height analysis not included.

2.3.3.1 Flood Hazard Zone Base Map. Flood insurance studies and FIRMs were used to prepare a base map of the study area that shows the extent of the 100-year tidal floodplain, i.e., the geographic scope of this study. Figure 2-23 shows the base map, including the **A** and **V** zones, and provide a regional perspective of the storm induced tidal flooding problem along the Island's south shore.

Stream corridors shown in the **A** zone on the FIRMs, but beyond the extent of tidal influence, are not shown on the base map. Generally, tidal exchange in south shore creeks is limited by cultural features, i.e., roads, spillways, and usually does not occur landward of Merrick Road, Montauk Highway, Sunrise Highway or the LIRR-Montauk line. Information on the extent of tidal influence in south shore streams from the Queens/Nassau boundary line to the Carmans River, Suffolk County was obtained from Koppelman, et al. (1982).

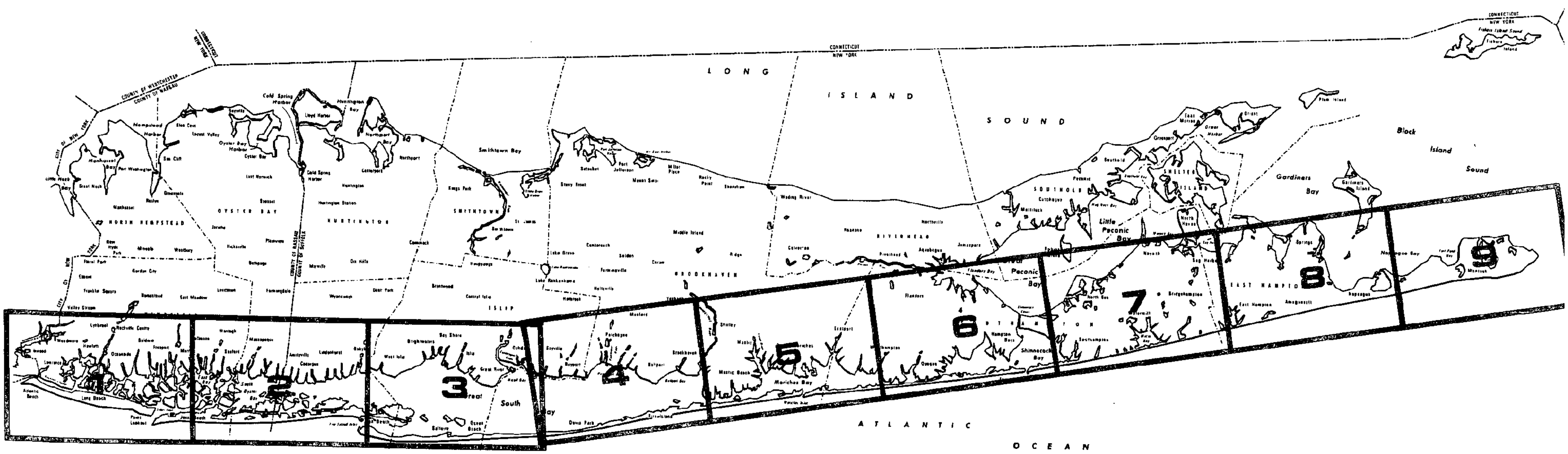


Figure 2-23
Index to the base map on pages 41 thru 49 showing the ***A*** *and* ***V*** *zones as per the FIRM's along the south shore.* →

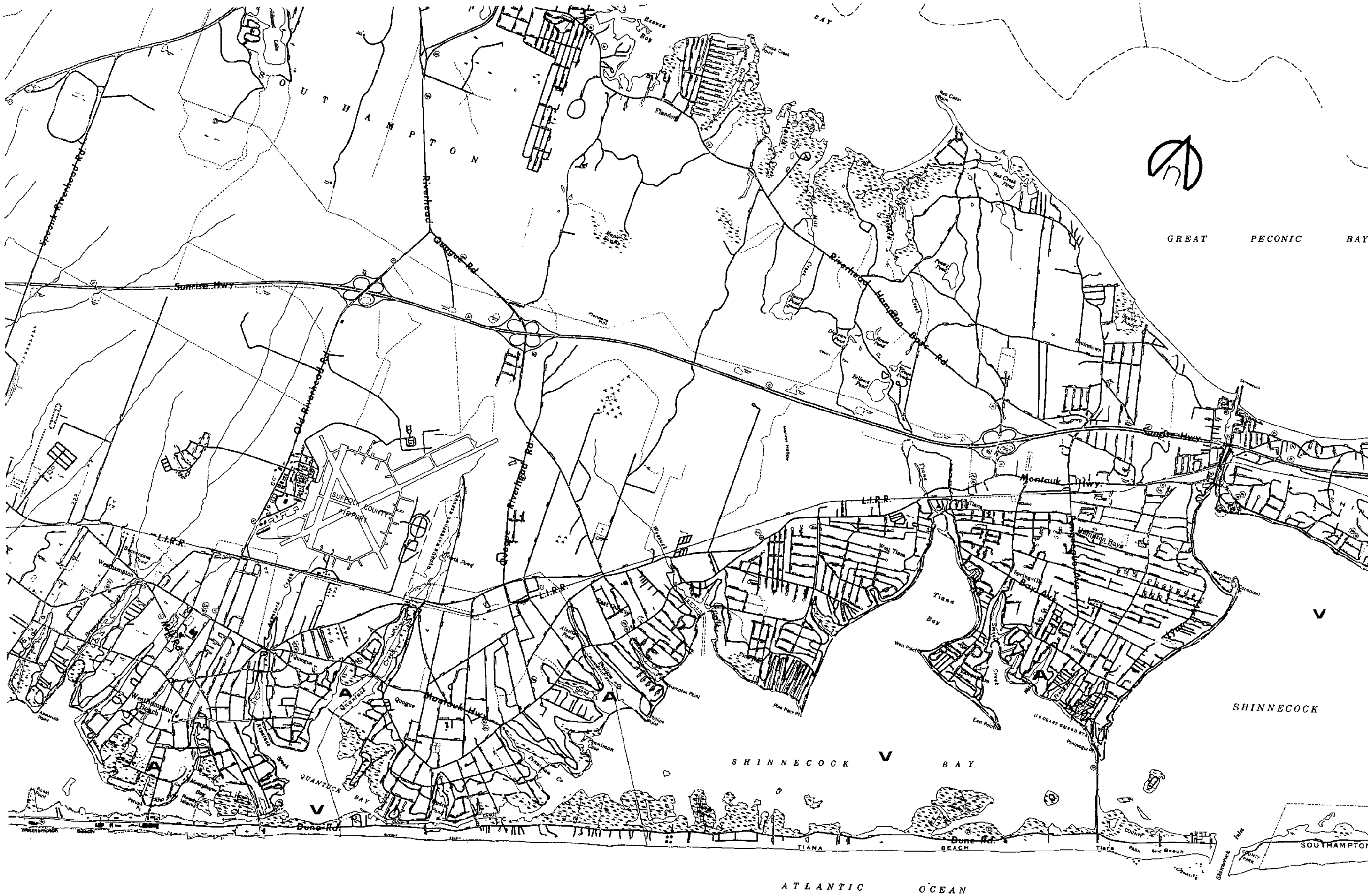

ATLANTIC
OCEAN
REYNOLDS
CHANNEL
LONG BEACH
MIDDLE BAY
JONES INLET
Hewlett Bay
Freeport Bay
Baldwin Bay
Merrick Bay
Bay of Fundy
BROAD CHANNEL
Lido Beach
Nassau Beach
Short Beach
SLOOP
A
V


OYSTER BAY
AMITYVILLE
COUNTY PARK
SLOOP CHANNEL
Amity Channel
Salt Pond
Ocean Pkwy
JONES BEACH
GILGO BEACH
ATLANTIC OCEAN


Sunrise Hwy
Union Blvd
East Islip
Brightwaters
Great Cove
Babylon Cove
HECKSCHER STATE PARK
RIVER
NICOLLS BAY
L.I.R.R.
West Channel
GREAT SOUTH BAY
ISLIP
Fire Islands
FIRE ISLAND NATIONAL SEASHORE
FIRE ISLAND INLET
ROBERT MOSES FIRE ISLAND STATE PARK
GREAT SOUTH BEACH
ATLANTIC OCEAN

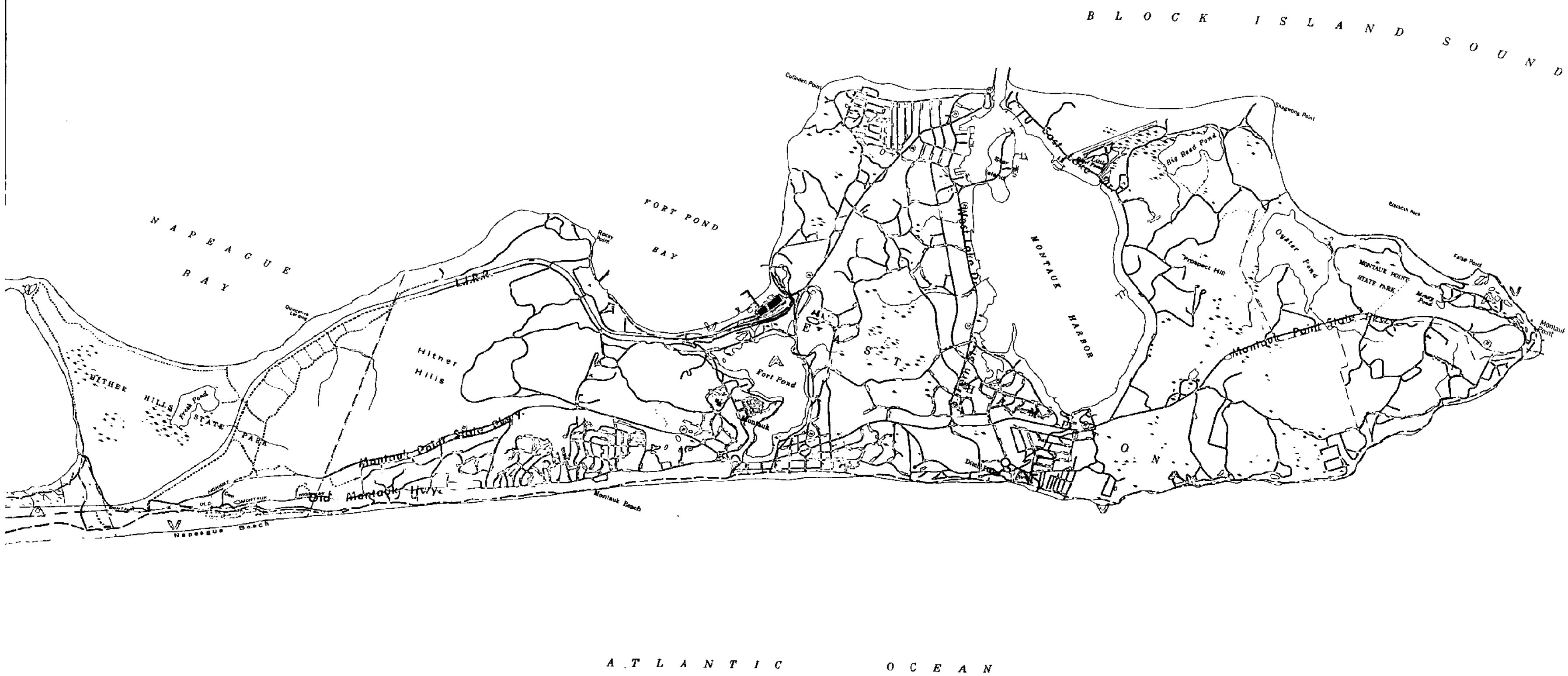
Sunrise Hwy
Woodside Ave
Horse Block Road
Montauk Hwy
PATCHOGUE BAY
G R E A T S O U T H B A Y
BELLPORT BAY
Bellport
North Bellport
Brookhaven
Sayville
Bayport
Blue Point
Brown Pt
Blue Pt
Water Island
Davis Park
F I R E I S L A N D
GREAT SOUTH BEACH
ATLANTIC OCEAN

Moriches Yaphank Rd
Chapmans Blvd
Capt Daniel Roe Hwy
Moriches Riverhead Rd
Sunrise Hwy
South Haven
LIRR
Montauk Hwy
Moriches
Forge River
Old Country Rd
Eastport
Speonk Riverhead Rd
L.I.R.R.
East Moriches
Hart Cove
Seatuck Cove
Tuthill Cove
MORICHES COAST GUARD STA
Speonk
Remsenburg
S. Country Rd
M O R I C H E S B A Y
N A R R O W B A Y
FIRE ISLAND
FIRE ISLAND
SEASHORE
GREAT SOUTH BEACH
SMITH POINT COUNTY PARK
COUNTY PARK
Cupsogue Beach
Dune Rd
A T L A N T I C
O C E A N


SOUTHAMPTON
GREAT PECONIC BAY
Speonk Riverhead Rd.
Riverhead Quogue Rd.
Sunrise Hwy
Old Riverhead Rd.
Quogue Riverhead Rd.
Riverhead Hampton Bays Rd.
Sunrise Hwy
Montauk Hwy.
L.I.R.R.
SUFFOLK COUNTY AIRPORT
Westhampton
Westhampton Beach
Quogue
Montauk Hwy.
West Tiana
Tiana Bay
Hampton Bays
Springville
Ponquogue
SHINNECOCK BAY
QUANTUCK BAY
SHINNECOCK
Dune Rd.
TIANA BEACH
ATLANTIC OCEAN
SOUTHAMPTON
Flanders
V
A


SOUTH RACE
LITTLE PEC
BAY
PECONIC BAY
NOYACK BAY
Sag Harbor Cove
Scallop Pond
North Sea Harbor
North Sea
Little Sebonac
Cold Spring Pond
Big Fresh Pond
Mill Pond
Water Mill
L.I.R.R.
Montauk Hwy
North Hwy
Tuckahoe
SOUTHAMPTON
Scuttle Hole Rd.
Halsey La.
Mecox Rd.
Sagg Rd.
Town Line Rd.
Bridgehampton
MECOX BAY
ATLANTIC OCEAN
A
V

GARDINERS BAY
ATLANTIC OCEAN
THREEMILE HARBOR
NORTHWEST HARBOR
SAG HARBOR BAY
NAPEAGUE BAY
Cedar Point
Northwest Woods
Gerard Park
King's Point
Sag Harbor Tpk
Stephen Hands Path
Cedar St
L.I.R.R.
Town La
Accabonack Rd
Montauk Hwy
Main St
East Hampton
Amagansett
Pantigo Rd
Further La
Bluff Rd
Napeague
Beach


B L O C K I S L A N D S O U N D
N A P E A G U E
B A Y
FORT POND
BAY
Hither
Hills
HITHER HILLS STATE PARK
Fort Pond
MONTAUK
HARBOR
Prospect Hill
Oyster Pond
Big Reed Pond
MONTAUK POINT STATE PARK
Montauk Point
Montauk Point State Pkwy.
Old Montauk Hwy.
Napeague Beach
Montauk Beach
E A S T
O N
A T L A N T I C O C E A N

2.3.4 Storms as Geologic Agents. Hurricanes and northeasters have played important roles in the modification of the shoreline. The present shoreline is, in fact, mainly the result of erosion and deposition caused by these storms. A severe northeaster or a hurricane can cause as much damage to the shore in a matter of a few hours as it would take normal weather conditions to produce in a hundred years. Observations indicate that

> ...most energy is expended in present-day nearshore-marine environments, not in a uniform constant manner but rather in sporadic bursts, or spurts, as a series of minor catastrophes (Hayes, 1967: 52).

Such a catastrophe occurred on September 21, 1938. In a few hours the storm surge of this hurricane leveled dunes along south shore beaches that had taken a hundred years to build. Hall (1939) found that the surge and storm waves of the 1938 hurricane breached most of the dunes on Fire Island that were less than 16 ft in elevation; after the storm, dune elevations were reduced to 5-8 ft. Dunes 18 ft or more in elevation were generally left intact, although deposits of sand on top of some of the higher dunes indicated that they, too, were overtopped. This storm created eight inlets in the barrier bar between Moriches Inlet and Southampton (Howard, 1939). Along the Rhode Island coast, the 1938 hurricane caused glacial cliffs 48 ft in height to recede over 33 ft (Brown, 1939). Highlighting the impact of major storms, Rich (1975) found that about two-thirds of the average annual beach recession along the south shore between Amagansett and Moriches Inlet during the period 1939-1972 was due to hurricane occurrence.

The shoreline effects of the hurricane of September 14, 1944 were also severe, despite its northeasterly track angling off Montauk. This storm cut back the bluffs at Shoreham, Long Island, a horizontal distance of over 39 ft; by undercutting the bluff base so that the face collapsed, the storm created a vertical cliff 11 ft high (New York, Joint Legislative Committee, 1947).

The effects of northeasters differ from those of hurricanes in that the latter produce higher tides (Davies, Axelrod and O'Connor, 1973). However, northeasters occur much more frequently than hurricanes, and the combined effect of two or more storms in a short period of time can be just as devastating to beaches that have not achieved full post-storm beach buildup. Therefore, similar shoreline changes can be expected from a hurricane, a severe northeaster, or several northeasters occurring in a short time interval. However, the magnitude of the changes will probably be larger in the instance of severe hurricanes since tidal inundation is the major cause of shoreline damage (Freeman, Baer and Jung, 1957).

The impact of the September 21, 1938 and the September 14, 1944 hurricanes on shores in the Long Island region have been well documented (Nichols and Marston, 1939; Howard, 1939; Brown, 1939; Chute, 1946). These studies indicate that there will be different results of severe storm occurrence for different shore environments. Two main types of shore environment are found along Long Island's shores: bluffed coasts (including headlands) and barrier bars (spits, barrier islands, barrier beaches, baymouth bars). Bluffed coasts are erosional features; barrier bars are primarily depositional features. The effects of hurricane attack on bluffed coasts and barrier bars are outlined in Table 2-6. The most dramatic changes—dune and bluff erosion and inlet formation—are the result of the storm surge, which for a few hours creates a new, submerged shoreline in areas not normally exposed to direct wave and tidal action.

Chute (1946) studied bluff recession along the southern Cape Cod coast caused by the hurricane of September 14, 1944. The magnitude of cliff recession was found to be related to several shoreline characteristics:

- Virtually no cliff recession occurred in those areas where the beach was at least 140 ft wide. Smaller beach widths were associated with cliffs that retreated up to 48 ft as a result of the storm. The wider beaches were effective in absorbing wave energy.
- High bluffs receded less than low bluffs. Given the same length of recession, more debris will slump to the base of a high bluff than a lower bluff. Therefore, more material must be removed by wave action at the base of the high bluffs in order for recession to occur.
- Vegetation and beach ridges at the bases of the bluffs retarded bluff erosion.
- Bluffs composed of till and clay were more resistant to wave attack than those composed primarily of sands.
- Seawalls were ineffective in curtailing bluff erosion unless they were constructed heavily enough to withstand direct wave impact. The seawalls must also be higher than the height of the storm surge and waves.

Table 2-6

Effects Of Hurricanes On The Long Island Shoreline

Bluffed Coasts	**Barrier Bars***
1. Beach recession. Mean high waterline migration landward as beach deposits are removed and transported offshore.	1. Beach recession. Mean high waterline migration landward as beach deposits are removed and transported offshore. A low, flat *hurricane beach profile* develops.
2. Bluff recession. Bluff and headland erosion due to direct wave attack during the peak of the surge flood.	2. Dune erosion. Dune scarps (vertical slopes) are formed as a result of wave attack. Overtopping occurs during time of peak surge.
3. Formation of benches. Benches are level or gently sloping planes inclined seaward. Formation of wave-cut bench widens the beach. Material eroded from the bluff is deposited on the beach face, and in some instances raises beach elevation above pre-storm levels.	3. Inlet formation. Inlets are formed by bayside ebb and overwash surges at locations where: a. the barrier is narrow and low in elevation; b. old inlets or washovers formed in the past; or c. the adjacent lagoon area is relatively deep, e.g., in dredged channels and tidal creeks (Leatherman and Joneja, 1980).
	4. Deposition of tidal deltas and overwash fans. Beach and dune sands are deposited in the bays and on the tidal marshes, increasing bar width.

Adapted from Koppelman, et al. (1976), Table 3.4, and Davies (1972), Fig. 11.

* Hurricane impacts on dune coasts in Southampton and East Hampton include beach recession and dune erosion.

These conclusions, based upon hurricane damage at Cape Cod, are generally applicable to similar situations found along the Island's shorelines where bluffs are present. Bluffs fronted by wide beaches would tend to erode less than those fronted by narrow beaches. Under the same conditions of wave attack, a high bluff would be cut back less than a low bluff. Vegetation stabilizing the bluff face also tends to retard erosion.

Howard (1939) and Nichols and Marston (1939) found that inlets formed in those sections of barrier bars that were narrow and low in elevation. Also, large areas of the bars were completely inundated at the peak of the storm surge. In their review of barrier island research, Leatherman and Joneja (1980) concluded that inlet creation and migration are the principal mechanisms responsible for landward barrier island migration along the Atlantic coast; overwash and aeolian activity were considered of secondary importance in this process.

The historical review of shoreline changes found in Leatherman and Joneja (1980) indicates that there have been many inlets in existence in the area extending from Fire Island Inlet to Southampton. Fire Island Inlet is the feature with the longest duration. Twenty-five inlets have been created and destroyed during recent historical time in this area. In general, the area from central Fire Island to the east has been more unstable than the area to the west. In the Moriches Inlet area, six inlets have opened and closed; in the Westhampton Beach area, five inlets opened and closed; and there have been eight inlets in existence from time to time in the vicinity of Shinnecock Inlet.

Severe storms move tremendous quantitites of sediment (Hayes, 1978). The widespread erosion and deposition of sediment is caused not only by breaking waves at the shore, but also by the dramatic increase in current velocities found in coastal ocean waters and in estuaries and lagoons. Storms can double or triple the maximum current velocity found at a particular location.

Millions of cubic yards can be moved by a severe storm along a barrier complex shore (Tanner, 1961). The U.S. Army Coastal Engineering Research Center (1977) has developed estimates of the average volume of sand eroded above mean sea level from beaches more than five miles long as a result of storm occurrence. Moderate storms may remove 4-10 yds^3/ft of beach front above msl; an extreme storm (or a moderate storm that persists for a long time) may remove 10-20 yds^3/ft; and rare storms, such as hurricane Donna, may remove 20-50 yds^3/ft. In comparison, a beach 100 ft wide at an elevation of 10 ft contains 37 yds^3/ft. This quantity would be adequate except for rare storm events. As for horizontal recession, even a moderate storm can erode a typical beach 75-100 ft, leaving it vulnerable to greater erosion if exposed to a second storm within a short period of time.

Storm activity does not necessarily cause all beaches to erode. Wind direction and coastal configuration can cause littoral drift to accumulate in areas downstream from those that are eroding (Zeigler, Hayes and Tuttle, 1959).

The shoreline has a remarkable ability to restore itself to its pre-storm condition (Nichols, 1967). Beach configuration is controlled by average, long-term sea state conditions (Zeigler, et al., 1964). Sediment is eventually restored to the beaches from bars offshore. The net effect of a severe storm on a bluffed coast would be cliff recession. Some bluff-eroded material remains on adjacent beaches. Barrier bars, on the other hand, would become wider and flatter. However, there may be a net loss in the sediment supply available for seasonal beach accretion as a result of storm occurrence. The berms on the beaches gradually build up a convex profile. Dunes, however, require many years to rebuild to their former heights. This process is often retarded by human interference (Leatherman, 1982).

2.4 SEA LEVEL RISE

Sea level rise is a phenomenon which is occurring globally. While a detailed review of the causes of sea level rise is not in the scope of this study, it should be pointed out that one of the contributors to sea level rise—the gradual warming of the lithosphere, atmosphere and hydrosphere—could also dramatically alter the frequency of severe storms in the North Atlantic region. Warmer ocean temperatures could shift the location of tropical cyclone genesis to higher latitudes. This could result in an increase of tropical storm occurrence in the Long Island area over the long-term.

It has been estimated that apparent sea level on the south shore of Long Island is rising at a rate of 3 mm/yr (0.1 in./yr) (Hicks 1973; 1978; 1981). At this rate, it would take approximately 100 years for sea level to rise 1 ft in elevation. Although the annual incremental rise is of minor consequence, the trend over the long-term has important ramifications for the stability and relative position of the shoreline. Zimmerman (1983) examined the effects of sea level rise on shoreline dynamics of the south shore of Long Island. The long-term sea level rise rate was utilized in a model that estimated the amount of shoreline recession in the area between Amagansett and Shinnecock Inlet. The study determined that an average annual landward shoreline migration of 3.3 ft could be expected if present conditions remain constant in the study area. Shoreline erosion would be demonstrated in both dune line recession and barrier island migration due to overwash.

The gradual rise in sea level may also, to varying degrees, result in the:

- mobilization of new sediment in the littoral system (This additional sediment may be lost to offshore areas.)
- gradual inundation of coastal structures, e.g., bulkheads, revetments, docks
- extension of flood zone areas inland
- displacement of coastal habitats, e.g., wetlands
- intrusion of salt water into aquifers and increased salinity in tributaries
- interference with gravity flow systems, e.g., storm water drainage

The specifications of engineered shoreline structures typically do not take into account the implications of sea level rise on design.

2.5 LAND USE BY CATEGORY IN THE FLOOD HAZARD ZONES

The land use data have been tabulated by land use classification within the **A** and **V** zones of each south shore municipality on Long Island. Table 2-7 illustrates the variety of activities within each land use classification. The land use information and color maps contained in the report, *Land Use-1981: Quantification and Analysis of Land Use of the Counties of Nassau and Suffolk* (LIRPB, 1982) were utilized to generate the acreage figures contained in this plan. The 1981 land use information presented in the LIRPB publication was prepared using 1980 aerial photographs, Nassau and Suffolk County tax maps and USGS maps, supplemented by field surveys to verify and update the data derived from the aerial photos. The quantification of the area/extent of each land use classification was accomplished using a new videodigitizing technique developed by Resources Planning Associates Inc. of Ithaca, N.Y.

The 1981 land use acreage for the 100-year south shore floodplain of Nassau and Suffolk Counties is displayed in Table 2-8. Nearly one-third of the 69,700 acres that comprise the 100-year floodplain lies within the **V** flood hazard zone, which is subject not only to flooding, but also wave action. Nearly two-thirds of the bi-county floodplain is located in Suffolk County.

Vacant land accounts for approximately 15% and 10% of the **A** and **V** zone acreage, respectively, in Suffolk County. Nassau County has less than 2% of its acreage in both the **A** and **V** zones categorized as vacant. Recreation and open space, agriculture, and vacant land use categories account for almost 65% of the **A** zone acreage and nearly 85% of the **V** zone acreage in Suffolk County. Similarly, for Nassau County almost 60% of the land in the **A** zone and over 95% of the land in the **V** zone is contained in the recreation and vacant land use categories. The **A** and **V** zone boundaries contained on the FIRMs for both the City of Long Beach and the Village of Atlantic Beach appear to be incorrectly mapped. If these two municipalities were remapped to reflect more extensive **A** and **V** zones, the percentage of land in the recreation and vacant land use categories within the **A** or **V** zones of Nassau County would be less than what is stated above.

Most of the residential land use in the Nassau County floodplain is at intermediate density (5-10 D.U./acre), while the majority of the residential land use in Suffolk County is at medium density (2-4 D.U./acre). The remaining land use categories—commercial, marine commercial, industrial, transportation and utility, and institutional—account for approximately 5% of the 100-year floodplain acreage on the south shore of Nassau and Suffolk Counties.

TABLE 2-7

Land Use Classifications-1981

Residential	
Low Density	- 1 D.U. or less/acre
Medium Density	- 2-4 D.U./acre
Intermediate Density	- 5-10 D.U./acre
High Density	- 11 or more D.U./acre
Commercial	
Hotels-Motels	Commercial establishments in which short term lodging is the major business activity— Hotels Motels Cabins
Retail & Services	Establishments whose main purpose is the sale or rendering of a personal service on a retail level and not listed under "offices."
Autmotive	Service Stations Dealers Repair, painting and washing Tire sales Seat cover installation
Recreational	Amusement parks Beaches and Pools (profit oriented) Billiards Bowling Dance (school, hall, studio, etc.) Day camps and nursery schools Miniature golf and driving ranges Theaters—indoor and drive-in Sports arenas, skating rinks Race tracks
Offices	Banks, credit agencies and loan companies Investment and securities Advertising, blueprinting and mailing services Doctors, dentists & legal services Medical labs and animal hospitals Employment and travel agencies

TABLE 2-7 (cont'd.)

Marine Commercial		Boat yards and marinas (private)
		Sales and services
		Fishery services
		Boat Storage
Institutional		
	Public	Schools (elementary, junior and senior high school)
		Colleges and universities
		Municipal buildings
		Courts
		Hospitals
		Post Offices
		Indian reservations
		Fire stations
	Quasi-Public	Churches, convents, seminaries
		Colleges and universities
		Nursing and rest homes
		Schools — parochial and private
		Synagogues and temples
		Fraternal organizations
		Hospitals
Industrial		
	Manufacturing	Production of a product — finished or unfinished
		Food products
		Printing, publishing and book-binding
	Non-Manufacturing	Warehousing, wholesaling
		Distributors
		Construction material, welding shops
		General contractors, masonry
		Salvage and junk yards
		Coal and oil bulk stations
	Mining	Used and abandoned sand pits
Recreational and Open Space		
	Public	Beaches and pools
		Golf courses, conservation and wildlife areas, arboretum
		Cemeteries
		Marinas and boat ramps
		Parks
		Playgrounds
	Quasi-Public	Beach clubs, golf clubs, gun clubs
		Cemeteries, scout camps and all non-profit recreation
	Parkways	Existing and proposed
Agriculture		
	Agriculture	Crop
		Orchard
		Poultry and ducks
		Dairy and livestock
		Nursery
		Greenhouse
Transportation-Utilities-Communications		
	Utilities	Pumping stations
		Water rights-of-way
		Electric rights-of-way
		Water and sewer treatment plants
	Transportation	Railroads
		Airports
		Taxi stands, bus depots, truck terminals
	Streets & Parking	All streets, public or private, paved or unpaved
		Driveways for a single use
		Public parking
		Private parking
		Parking garages
	Expressways	Existing and proposed
Vacant		
	Vacant	Tidal land
		Land not in use
		Land containing abandoned buildings
		Urban renewal-approved areas
Water		
	Inland	Recharge basins, drainage areas
		Lakes and inland fresh water
	Tidal	South Shore only:
		Channels and bays (excludes Peconic Bay)
		Wetlands — conservation water areas

TABLE 2-8

1981 Land Use By Municipality For South Shore Flood Hazard Zones

		Residential					Commercial								
	Total	Low Density	Medium Density	Intermediate Density	High Density	Total	Commercial	Marine Commercial	Total	Industrial	Transportation Utility Communication	Institutional	Recreation	Agriculture	Vacant
Town of Hempstead															
Acres in A Zone	15,551	28	129	4,190	83	4,430	297	377	674	199	241	425	9,295	0	287
Acres in V Zone	5,819	0	0	98	28	126	1	41	42	0	128	59	5,419	0	45
Total	21,370	28	129	4,288	111	4,556	298	418	716	199	369	484	14,714	0	332
Unincorporated Areas															
Acres in A Zone	12,524	0	55	3,192	71	3,318	256	265	521	162	220	382	7,688	0	233
Acres in V Zone	5,800	0	0	98	28	126	1	29	30	0	128	59	5,413	0	44
Total	18,324	0	55	3,290	99	3,444	257	294	551	162	348	441	13,101	0	277
Atlantic Beach															
Acres in A Zone	72	0	5	10	0	15	0	37	37	0	0	2	10	0	8
Acres in V Zone	19	0	0	0	0	0	0	12	12	0	0	0	6	0	1
Total	91	0	5	10	0	15	0	49	49	0	0	2	16	0	9
Cedarhurst															
Acres in A Zone	78	0	0	60	0	60	5	0	5	0	4	9	0	0	0
Far Rockaway															
Acres in A Zone	178	0	0	138	0	138	13	19	32	0	0	6	1	0	1
Freeport															
Acres in A Zone	991	0	2	559	10	571	5	43	48	35	13	13	297	0	14
Hewlett Bay Park															
Acres in A Zone	9	4	0	0	0	4	0	0	0	0	0	0	5	0	0
Hewlett Harbor															
Acres in A Zone	112	0	50	0	0	50	0	0	0	0	0	0	62	0	0
Hewlett Neck															
Acres in A Zone	12	0	11	0	0	11	0	1	1	0	0	0	0	0	0
Island Park															
Acres in A Zone	205	0	0	153	2	155	18	10	28	2	4	10	6	0	0
Lawrence															
Acres in A Zone	1,231	24	1	31	0	56	0	2	2	0	0	0	1,142	0	31
Rockville Centre															
Acres in A Zone	5	0	0	2	0	2	0	0	0	0	0	0	3	0	0
Valley Stream															
Acres in A Zone	48	0	0	45	0	45	0	0	0	0	0	3	0	0	0
Woodsburgh															
Acres in A Zone	86	0	5	0	0	5	0	0	0	0	0	0	81	0	0

TABLE 2-8 (cont'd.)

		Residential					Commercial								
	Total	Low Density	Medium Density	Intermediate Density	High Density	Total	Commercial	Marine Commercial	Total	Industrial	Transportation Utility Communication	Institutional	Recreation	Agriculture	Vacant
City of Long Beach															
Acres in A Zone	226	0	0	132	24	156	3	0	3	0	15	28	12	0	12
Acres in V Zone	77	0	0	0	5	5	0	0	0	0	0	0	62	0	10
Total	303	0	0	132	29	161	3	0	3	0	15	28	74	0	22
Town of Oyster Bay															
Acres in A Zone	1,393	0	558	611	66	1,235	17	8	25	0	0	34	94	0	5
Acres in V Zone	2,406	0	0	0	0	0	0	0	0	0	0	0	2,406	0	0
Total	3,799	0	558	611	66	1,235	17	8	25	0	0	34	2,500	0	5
Unincorporated Areas															
Acres in A Zone	1,379	0	545	611	66	1,222	17	8	25	0	0	34	93	0	5
Acres in V Zone	2,406	0	0	0	0	0	0	0	0	0	0	0	2,406	0	0
Total	3,785	0	545	611	66	1,222	17	8	25	0	0	34	2,499	0	5
Massapequa Park															
Acres in A Zone	14	0	13	0	0	13	0	0	0	0	0	0	1	0	0
NASSAU COUNTY															
Acres in A Zone	17,170	28	687	4,933	173	5,821	317	385	702	199	256	487	9,401	0	304
Acres in V Zone	8,302	0	0	98	33	131	1	41	42	0	128	59	7,887	0	55
Total	25,472	28	687	5,031	206	5,952	318	426	744	199	384	546	17,288	0	359
Town of Babylon															
Acres in A Zone	2,925	26	279	1,115	57	1,477	32	113	145	10	55	21	1,104	0	113
Acres in V Zone	4,611	0	115	0	0	115	4	0	4	0	0	0	4,477	0	15
Total	7,536	26	394	1,115	57	1,592	36	113	149	10	55	21	5,581	0	128
Unincorporated Areas															
Acres in A Zone	1,871	0	146	476	45	667	30	46	76	5	55	15	988	0	65
Acres in V Zone	4,611	0	115	0	0	115	4	0	4	0	0	0	4,477	0	15
Total	6,482	0	261	476	45	782	34	46	80	5	55	15	5,465	0	80
Amityville															
Acres in A Zone	379	0	59	180	12	251	1	27	28	0	0	4	65	0	31
Babylon															
Acres in A Zone	391	26	64	249	0	339	0	24	24	0	0	2	15	0	11
Lindenhurst															
Acres in A Zone	284	0	10	210	0	220	1	16	17	5	0	0	36	0	6
Town of Islip															
Acres in A Zone	9,901	433	2,088	399	29	2,949	13	117	130	29	96	524	5,514	0	659
Acres in V Zone	678	0	36	43	0	79	0	0	0	0	0	33	526	0	40
Total	10,579	433	2,124	442	29	3,028	13	117	130	29	96	557	6,040	0	699

TABLE 2-8 (cont'd.)

	Total	Residential: Low Density	Residential: Medium Density	Residential: Intermediate Density	Residential: High Density	Residential: Total	Commercial: Commercial	Commercial: Marine Commercial	Commercial: Total	Industrial	Transportation Utility Communication	Institutional	Recreation	Agriculture	Vacant
Unincorporated Areas															
Acres in A Zone	9,638	433	2,032	338	29	2,832	9	117	126	29	96	533	5,490	0	542
Acres in V Zone	606	0	31	37	0	68	0	0	0	0	0	33	481	0	24
Total	10,244	433	2,063	375	29	2,900	9	117	126	29	96	556	5,971	0	566
Brightwaters															
Acres in A Zone	46	0	35	4	0	39	0	0	0	0	0	0	3	0	4
Ocean Beach															
Acres in A Zone	70	0	1	53	0	54	4	0	4	0	0	1	11	0	0
Acres in V Zone	16	0	0	5	0	5	0	0	0	0	0	0	11	0	0
Total	86	0	1	58	0	59	4	0	4	0	0	1	22	0	0
Saltaire															
Acres in A Zone	147	0	20	4	0	24	0	0	0	0	0	0	10	0	113
Acres in V Zone	56	0	5	1	0	6	0	0	0	0	0	0	34	0	16
Total	203	0	25	5	0	30	0	0	0	0	0	0	44	0	129
Town of Brookhaven															
Acres in A Zone	10,493	251	1,243	435	2	1,931	40	126	166	25	44	249	6,699	190	1,189
Acres in V Zone	3,744	15	74	289	0	378	6	0	6	0	0	0	3,305	0	55
Total	14,237	266	1,317	724	2	2,309	46	126	172	25	44	249	10,004	190	1,244
Unincorporated Areas															
Acres in A Zone	10,322	214	1,220	432	0	1,866	35	126	161	18	42	246	6,638	190	1,161
Acres in V Zone	3,744	15	74	289	0	378	6	0	6	0	0	0	3,305	0	55
Total	14,066	229	1,294	721	0	2,244	41	126	167	18	42	246	9,943	190	1,216
Bellport															
Acres in A Zone	92	37	1	0	0	38	0	0	0	0	0	0	29	0	25
Patchogue															
Acres in A Zone	79	0	22	3	2	27	5	0	5	7	2	3	32	0	3
Town of Southampton															
Acres in A Zone	4,352	807	542	6	2	1,357	14	70	84	11	15	161	359	487	1,878
Acres in V Zone	2,923	630	375	9	11	1,025	148	27	175	0	5	4	766	0	948
Total	7,275	1,437	917	15	13	2,382	162	97	259	11	20	165	1,125	487	2,826
Unincorporated Areas															
Acres in A Zone	2,874	315	454	6	2	777	5	48	53	8	8	149	187	473	1,219
Acres in V Zone	1,402	167	202	9	11	289	59	27	86	0	3	4	594	0	326
Total	4,276	482	656	15	13	1,166	64	75	139	8	11	153	781	473	1,545

TABLE 2-8 (cont'd.)

	Total	Residential: Low Density	Residential: Medium Density	Residential: Intermediate Density	Residential: High Density	Residential: Total	Commercial: Commercial	Commercial: Marine Commercial	Commercial: Total	Industrial	Transportation Utility Communication	Institutional	Recreation	Agriculture	Vacant
Quogue															
Acres in A Zone	439	74	28	0	0	102	0	9	9	0	3	1	34	0	290
Acres in V Zone	531	196	32	0	0	228	23	0	23	0	2	0	47	0	231
Total	970	270	60	0	0	330	23	9	32	0	5	1	81	0	521
Southampton															
Acres in A Zone	557	313	0	0	0	313	0	12	12	0	1	5	76	14	136
Acres in V Zone	564	217	0	0	0	217	2	0	2	0	0	0	21	0	324
Total	1,121	530	0	0	0	530	2	12	14	0	1	5	97	14	460
Westhampton Beach															
Acres in A Zone	482	105	60	0	0	165	9	1	10	3	3	6	62	0	233
Acres in V Zone	426	50	141	0	0	191	64	0	64	0	0	0	104	0	67
Total	908	155	201	0	0	356	73	1	74	3	3	6	166	0	300
Town of East Hampton															
Acres in A Zone	3,358	300	177	16	0	493	66	0	66	0	145	39	1,358	131	1,126
Acres in V Zone	1,244	102	75	0	2	179	24	0	24	0	4	15	699	47	276
Total	4,602	402	252	16	2	672	90	0	90	0	149	54	2,057	178	1,402
Unincorporated Areas															
Acres in A Zone	2,759	124	160	16	0	300	65	0	65	0	145	36	1,242	65	906
Acres in V Zone	1,172	87	74	0	2	163	24	0	24	0	4	14	665	46	256
Total	3,931	211	234	16	2	463	89	0	89	0	149	50	1,907	111	1,162
East Hampton															
Acres in A Zone	599	176	17	0	0	193	1	0	1	0	0	3	116	66	220
Acres in V Zone	72	15	1	0	0	16	0	0	0	0	0	1	34	1	20
Total	671	191	18	0	0	209	1	0	1	0	0	4	150	67	240
SUFFOLK COUNTY															
Acres in A Zone	31,029	1,817	4,329	1,971	90	8,207	165	426	591	75	355	994	15,034	808	4,965
Acres in V Zone	13,200	747	675	341	13	1,776	182	27	209	0	9	52	9,773	47	1,334
Total	44,229	2,564	5,004	2,312	103	9,983	347	453	800	75	364	1,046	24,807	855	6,299
BI-COUNTY REGION															
Acres in A Zone	48,199	1,845	5,016	6,904	263	14,028	482	811	1,293	274	611	1,481	24,435	808	5,269
Acres in V Zone	21,502	747	675	439	46	1,907	183	68	251	0	137	111	17,660	47	1,389
Total	69,701	2,592	5,691	7,343	309	15,935	665	879	1,544	274	748	1,592	42,095	855	6,658

2.6 INVENTORY AND VALUE OF STRUCTURES BY LAND USE CATEGORY IN FLOOD HAZARD ZONES

2.6.1 Introduction. The two most drastic potential effects of hurricanes are fatalities and property damage. Since the turn of the century, the general trend has been toward a reduction in the number of deaths from hurricanes, but an exponential increase in the amount of property damage. Figure 2-24 illustrates these trends from 1900 to today.

The deadliest U.S. hurricanes were the 1900 storm in Galveston, Texas, where 6000 people were killed, and the 1928 hurricane, which took 1800 lives at Lake Okeechobee, Florida. Since these events, hurricanes have not killed a substantial number of people. The main reasons for the reduction and stabilization in the nationwide death rate attributable to hurricanes has been a combination of improvements in monitoring and warning systems, and local preparedness and evacuation planning (White, et al. 1976). However, where population exceeds the safe evacuation capacity, the potential for substantial loss of human life remains.

While hurricane fatalities have decreased since 1900, the increase in property damages is staggering. This increase in damages parallels the increase in population and development in coastal hurricane-prone areas since World War II. The two costliest U.S. hurricanes were Hurricane Frederic, which caused $2.3 billion in damages throughout the Gulf Coast states in 1979, and Hurricane Agnes, which wrought $2.1 billion worth of destruction in the northeast in 1972 (Herbert and Taylor, 1983).

Structures inventoried include those residential, commercial, industrial, marine commercial and institutional structures located within the **A** and **V** zones of each south shore municipality on Long Island. It is important to note, however, that the basic **unit** inventoried varies among the land use categories. In the residential category, the unit inventoried is the structure itself. However, commercial and industrial structures cannot be similarly inventoried, because a small store is vastly different from a department store building. Thus, for these categories the basic unit inventoried is square feet of floor space. The basic unit inventoried in the marine commercial category is the number of boat slips. Institutional structures will be quantified by municipality.

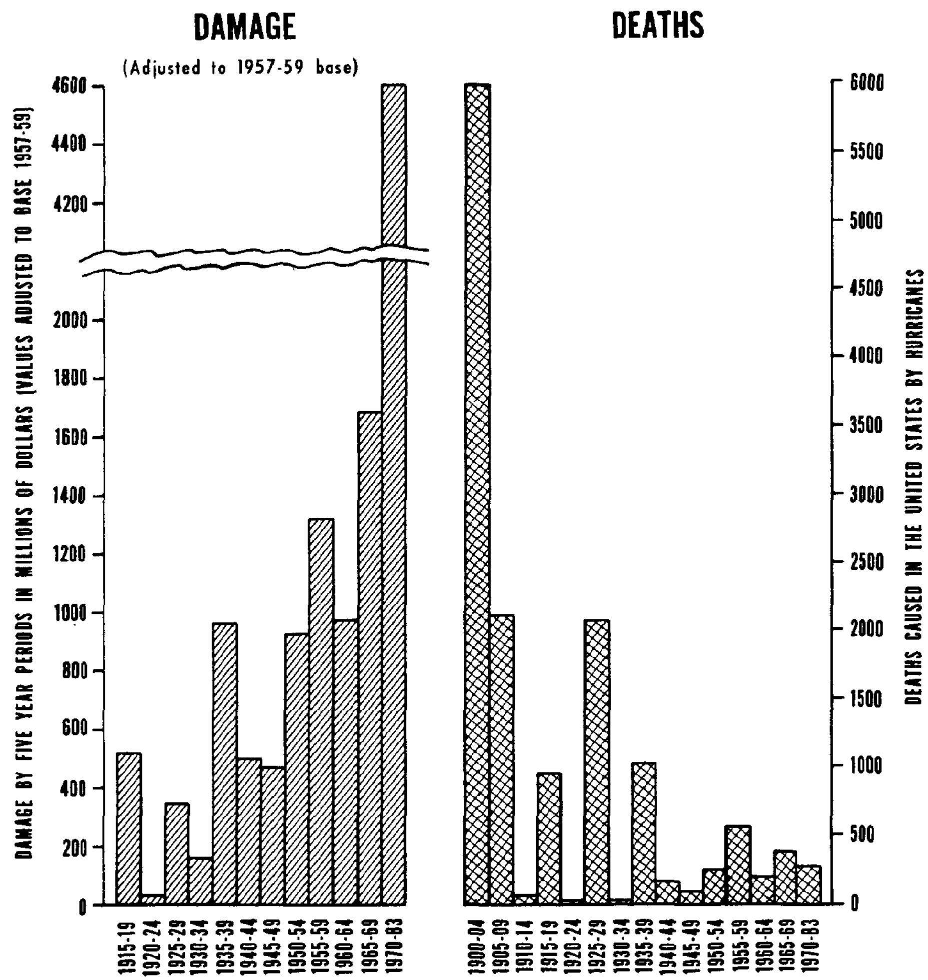


Figure 24
Deaths and Damages from Hurricanes in the United States (National Oceanic and Atmospheric Administration, 1972; Herbert and Taylor, 1983)

An extensive data base consisting of aerial photography, census information, land use maps and FIRMs was used to prepare composite storm hazard maps for the entire south shore of Nassau and Suffolk Counties. The composite map series, together with field checks when necessary, served as the basis for the structure inventory. The structure inventory in turn served as input for quantification of value of structures by land use category along that portion of the south shore of Long Island vulnerable to tidal-induced flooding from hurricanes and northeast storm events.

The LIRPB originally planned to utilize COE damage functions, as well as results from the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Reformulation Study, in estimating structural loss due to certain flood events. However, the revised timetable of the COE project unfortunately did not coincide with the completion of this plan. Therefore, a change in strategies was required. The structural value at risk was determined rather than the projected structural loss. Without the COE flood damage functions, it was not possible to predict potential flood damages in the event of a major storm.

Damage to hazardous materials storage facilities located within the 100-year floodplain may present potential threats to health and the environment as a result of a hurricane or northeast storm. This plan identifies the facility locations, their contents and storage capacities where appropriate. It is important to note that facilities such as gas stations and home oil storage tanks, will be excluded since they are ubiquitous in flood hazard areas.

It has been determined that there are 2349 single or two-family residential structures and 485 units of multi-family housing located within the Long Island south shore **V** zone valued at $331 million. In addition, there are 36,353 single or two-family residential structures and 1335 units of multi-family housing located within the south shore **A** zone valued at $2.8 billion. Commercial floor space totals 72,000 square feet in the **V** zone and over 3 million square feet in the **A** zone. There is no industrial floor space in the Long Island south shore **V** zone. Approximately 1.5 million square feet of industrial floor space exists in the **A** zone. Commercial and industrial structures located in the 100-year floodplain are valued at $101 million and $39 million, respectively. Nearly 17,000 boat slips on the south shore are vulnerable in a severe storm event; approximately $400 million worth of recreational boats are at risk on the south shore. Over 50 institutional structures are located in the **A** and **V** flood hazard zones. A residential, commercial, and industrial structural value totaling $3.2 billion is at risk within Long Island's south shore **A** and **V** zones. Approximately one-tenth of this total is located within the high hazard **V** zone.

This $3.2 billion value is not a projection of expected hurricane losses. Instead, it represents only the value of residential, commercial and industrial structures at risk within the 100-year floodplain, the area most affected by a major hurricane. While it is unlikely that a major storm would destroy these structures to their full value, damage from such a storm could be substantial. In addition, there are a number of public and quasi-public buildings, as well as a significant infrastructure investment at risk that have not been included in the calculations. For example, the value of institutional buildings, such as schools, hospitals, or churches located in the floodplain, has not been determined. Utilities, including water and sewage treatment plants, pumping stations, telecommunication and electrical facilities were not inventoried. The value of roads in the floodplain was not calculated; nor was the value of the many park facilities along Long Island's south shore, including the substantial infrastructure investment there. Many of these facilities are likely to be damaged or destroyed in a major hurricane, and would require a substantial public investment to rebuild. The plan does not include the value of the interior contents of the many homes or commercial and industrial structures along the south shore; nor the structural value at risk outside of the south shore 100-year floodplain or along the north shore coast. In addition, the value of agricultural equipment and crops in the floodplain was not determined. While the LIRPB's calculations clearly illustrate a substantial structural value at risk, the value of structural improvements within the south shore 100-year floodplain, but not included in the value at risk figures for this plan, are also significant.

Long Island has experienced tremendous growth along the south shore since World War II. Much of this development has occurred in the flood hazard area and in coastal areas **wiped clean** by the 1938 hurricane. Today, with over $3 billion at risk in the south shore flood zone, Long Island has the potential to become the next site of the nation's costliest hurricane.

2.6.2 Residential Structures

2.6.2.1 Single and Two-family Structures. Once the preparation of the composite storm hazard map was complete, the structures were inventoried. Using the 100-year floodplain as the boundary of the study area, individual single and two-family houses were counted from 1980 aerial blueprints and aggregated by 1980 Census block and tract. The tabulation of single and two-family residential structures was further aggregated into cities, towns, villages and unincorporated places for Nassau and Suffolk Counties as shown and described in Fig. 2-25, Municipalities and *Census Designated Places* (CDPs)-1980. To determine the values of single and two-family homes in the **A** and **V** zones, the number of structures counted in a given census block outlined on the aerial composite maps was multiplied by the mean structure value given in the 1980 Census report. The resulting total structural value at risk for each census block was then summed to the tract level, and compiled by municipality and CDP. Multi-family houses, apartment buildings, and condominiums were not counted at this time and are inventoried separately below. Table 2-9 presents the number and value of single and two-family houses found in the 100-year floodplain of Nassau County, and Table 2-10 presents the same information for Suffolk County.

In examining these figures and assessing a community's vulnerability to storm damages, it is necessary to examine both the **severity** and **magnitude** of risk that exist in each community. The severity of risk is a function of the number and intensity of physical forces (storm surge, wave action, wind) that a storm is likely to impose on a particular area. The magnitude of risk is basically a function of the number of houses exposed to severe storm forces in a community. Thus, it can be expected that a community with many houses in the **V** zone will experience a greater percentage of structural loss than a community where houses are predominantly located in the **A** zone. In the event of a severe storm, the **V** zone represents the area of greatest risk, and thus, can be expected to suffer the greatest damage. However, communities with houses in the **A** zone are still subject to storm damage and should not necessarily be considered free from danger.

In 1980, the community of Point Lookout/Lido Beach contained 120 houses in the **V** zone. By contrast, Freeport contained 3084 houses in the **A** zone. While the severity of hurricane damage may be expected to be greater at Point Lookout/Lido Beach, the overall magnitude of destruction may be greater in Freeport. Other Nassau County communities with a significant number of residential structures—all in the **A** zone—are:

Woodmere - 1796 houses
Oceanside - 1783 houses
Massapequa - 2395 houses

The total number of single and two-family houses in the floodplain along the south shore of Nassau County is 21,687. There are single and two-family residential structures worth $11 million in the **V** zone, and $1.5 billion in the **A** zone, of the south shore of Nassau County.

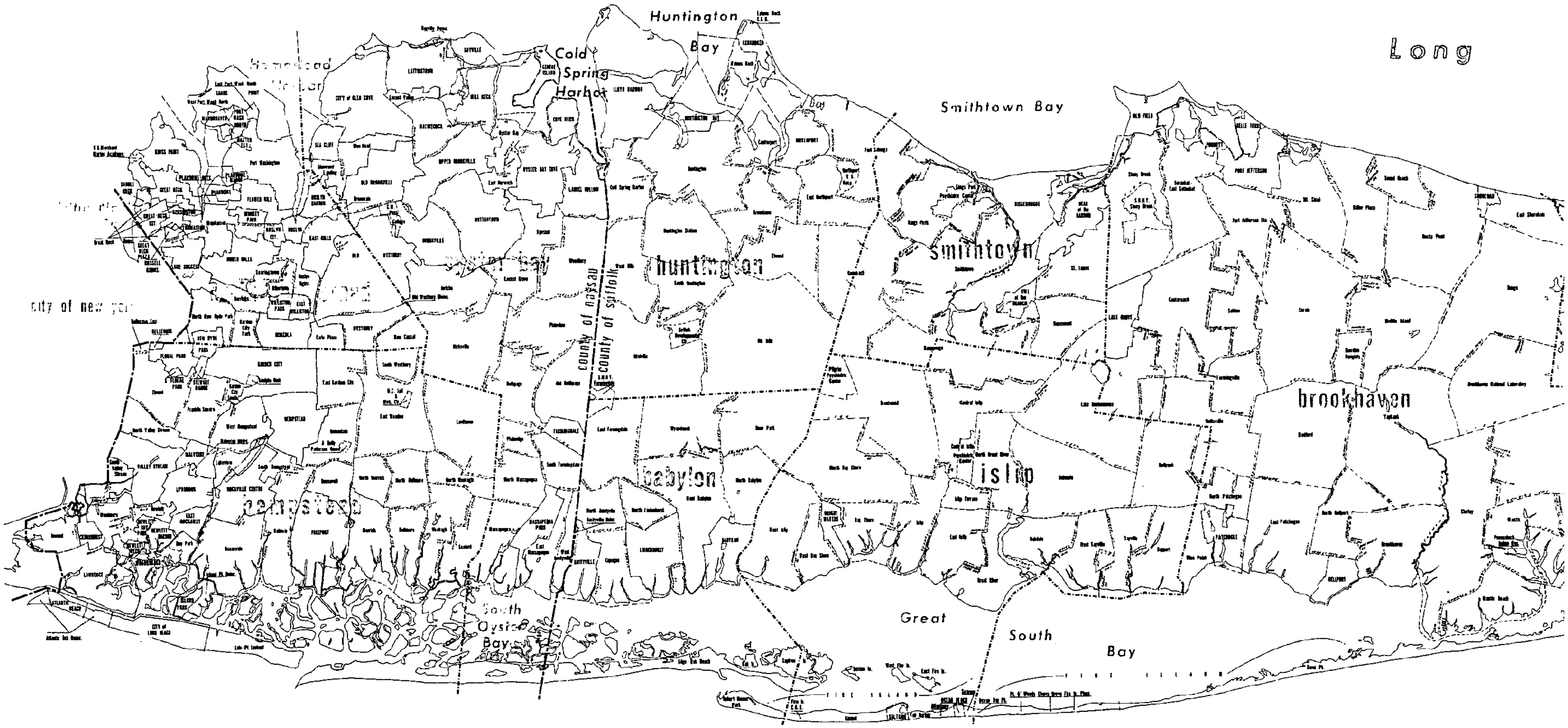
Housing counts in Suffolk County record many more houses in the **V** zone, due to residential development on the barrier islands from Gilgo Beach to Southampton. In Suffolk County as a whole, there are 2229 houses valued at $300 million in the **V** zone and 15,427 houses valued at $1.3 billion in the **A** zone for a total of 17,656 single and two-family houses at risk in the south shore floodplain. Those communities with the greatest number of houses at risk are:

Fire Island communities - 586 in **V** zone; 2991 in **A** zone
Copiague - 1823 in **A** zone
Mastic Beach - 986 in **A** zone
Babylon, Village of - 957 in **A** zone

Thus, the value of single and two-family structures within the Long Island south shore floodplain is over $3 billion.

The severity of risk is clearly greatest on the barrier islands, which must bear the full brunt of both wave action and storm surge associated with hurricanes and northeast storms. While only 20% of the housing stock in the floodplain is located on the barrier islands, 86% of all the structures in the **V** zone are located on the barrier islands. Table 2-11 presents the number and value of houses on each barrier island.

A note of interest: in 1938 there were 179 houses between the Village of Quogue and Moriches Inlet on the Westhampton Beach barrier island. The hurricane of September 21, 1938 destroyed all but a dozen of those houses (Clowes, 1939). In 1980, there were 915 single or two-family homes along that same stretch of beachfront.


Huntington
Bay
Cold
Spring
Harbor
Long
Smithtown Bay
huntington
smithtown
brookhaven
county of nassau
county of suffolk
babylon
islip
Great
South
Bay
South
Oyster
Bay

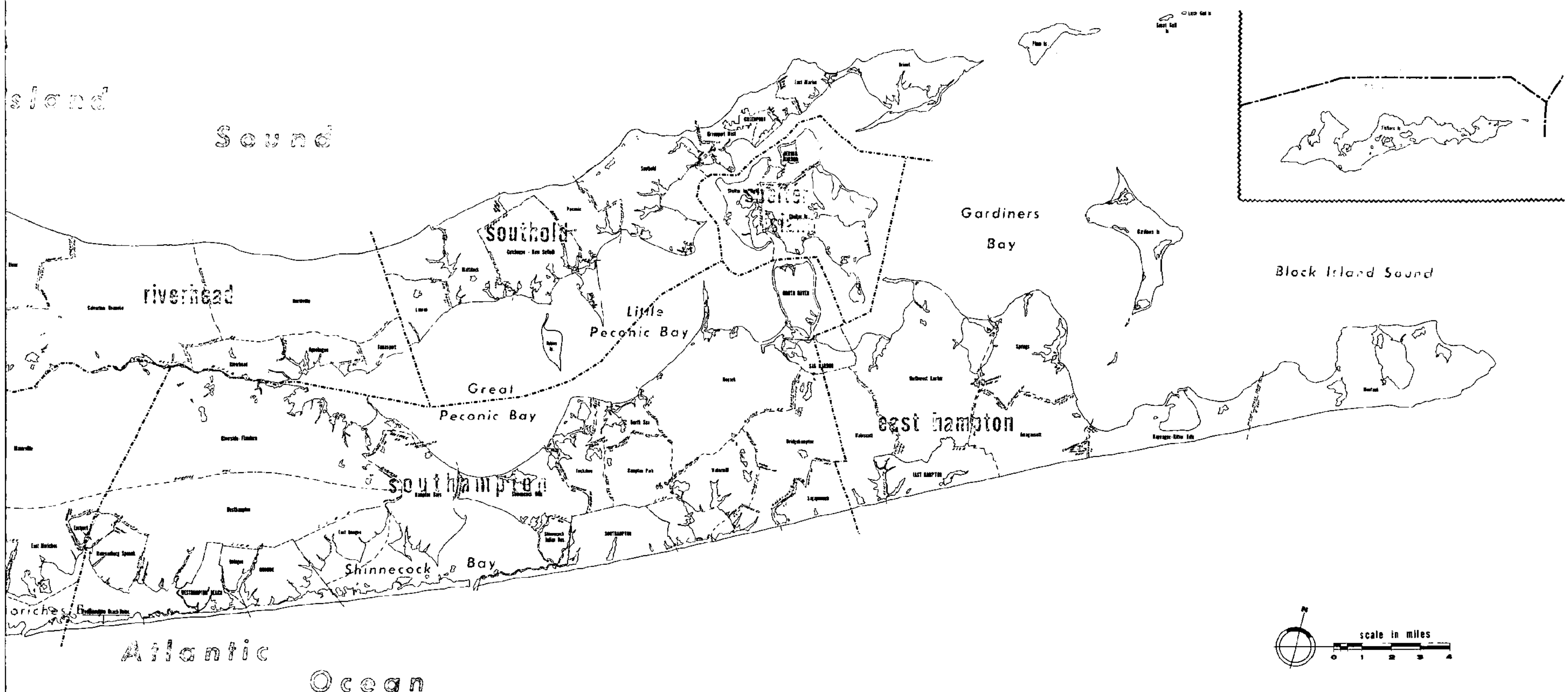


Figure 2-25
Municipalities and Census Designated Places (CDP's)–1980

TABLE 2-9

Number and Value of Single and Two-Family Residential Structures in the South Shore Flood Hazard Zones of Nassau County

Municipality	"V" Zone Structures	"V" Value (in millions of $)	"A" Zone Structures	"A" Value (in millions of $)	Total Value (in millions of $)
Village of Cedarhurst			182	10.8	10.8
Inwood			55	2.5	2.5
Village of Atlantic Beach			141	14.2	14.2
Atlantic Beach (Uninc.)			240	23.1	23.1
South Valley Stream			514	42.9	42.9
Village of Lawrence			37	6.3	6.3
Woodmere			1,796	185.3	185.3
Village of Woodsburgh			2	4.0	4.0
Village of Valley Stream			217	20.7	20.7
Village of Hewlett Neck			6	1.2	1.2
Village of Hewlett Harbor			11	2.3	2.3
Bay Park			762	34.0	34.0
Village of East Rockaway			582	40.0	40.0
Village of Island Park			914	41.0	41.0
Island Park (Uninc.)			416	27.0	27.0
Oceanside			1,783	113.8	113.8
Village of Rockville Centre			7	.5	.5
Lido-Pt. Lookout	120	11.0	1,212	96.6	107.6
Baldwin			1,015	63.3	63.3
Village of Freeport			3,084	141.5	141.5
Merrick			1,182	116.0	116.0
Bellmore			978	83.7	83.7
Wantagh			779	44.5	44.5
Seaford			1,046	52.4	52.4
TOWN OF HEMPSTEAD TOTAL	120	11.0	16,961	1,167.6	1,178.6
CITY OF LONG BEACH* TOTAL			995	50.6	50.6
Massapequa			2,395	161.0	161.0
Village of Massapequa Park			118	13.1	13.1
East Massapequa			814	61.3	61.3
West Amityville			284	14.5	14.5
TOWN OF OYSTER BAY TOTAL			3,611	249.9	249.9
NASSAU COUNTY TOTAL	120	$11.0	21,567	$1468.1	$1474.1

*Most of the City of Long Beach is not within the **A** or **V** Zone as mapped by FEMA.

Tables 2-12 and 2-13 present those communities with the highest single and two-family residential value at risk in sequential order. The Village of Westhampton Beach, the unincorporated portion of Westhampton, and the Brookhaven section of Fire Island show the highest value at risk in the **V** zone in Table 2-12. Table 2-13 shows the Islip portion of Fire Island, and the communities of Woodmere and Massapequa, to have the highest residential value at risk in the **A** zone.

There were certain problems inherent in the methodology that was employed in calculating the value of structures at risk. The residential structural values represent the market prices from 1980 Census data, while commercial, industrial, and multi-family structural values were culled from tax assessment records. The market prices contained in the 1980 Census data for residential property include the value of both the land and structures, while the tax assessment values for commercial and industrial properties represent structural value only. In most cases, the tax assessment values, even where equalization rates are applied, are significantly lower than the market values. In some cases, the tax assessment value is less than one half the market value.* The non-residential values presented in this report are therefore likely to understate the true worth of such properties.

Finally, a problem existed in respect to the location of the floodplain boundary. The FIRMs prepared by FEMA were used as a guide to the 100-year floodplain **A** and **V** zones. However, in certain cases, this boundary appeared to be incorrect. Most notably, the FIRM boundary for the City of Long Beach excluded the majority of the city from the 100-year floodplain. In view of the topography and lack of natural or structural protection along this barrier island, this boundary is believed to be incorrect.

* Personal communication, Mr. Charles King, Director of Assessment Review, Nassau County, Mineola, N.Y.

TABLE 2-10

Number and Value of Single and Two-Family Residential Structures in the South Shore Flood Hazard Zones of Suffolk County

Municipality	"V" Zone Structures	"V" Value (in millions of $)	"A" Zone Structures	"A" Value (in millions of $)	Total Value (in millions of $)
Village of Amityville			758	48.3	48.3
Copiague			1,823	83.3	83.3
Village of Lindenhurst			831	32.4	32.4
West Babylon			575	27.0	27.0
Gilgo/Oak Beach	324	31.3	119	11.2	42.5
Village of Babylon			957	58.3	58.3
TOWN OF BABYLON TOTAL	324	31.3	5,063	260.5	291.8
West Islip			689	60.6	60.6
West Bay Shore			75	6.1	6.1
Fire Island (Islip)	236	27.2	1,673	190.9	218.1
Fire Island (Brook.)	350	43.8	1,318	157.4	201.2
Fire Island Total	586	71.0	2,991	348.3	419.3
Village of Brightwaters			56	4.1	4.1
Bay Shore			308	20.4	20.4
Islip			135	13.7	13.7
East Islip			77	9.7	9.7
Great River			21	2.3	2.3
Oakdale			681	41.3	41.3
West Sayville			88	2.6	2.6
Bayport			184	12.1	12.1
Sayville			98	6.7	6.7
TOWN OF ISLIP TOTAL	236	27.2	4,203	377.2	404.4
Blue Point			148	8.0	8.0
Village of Patchogue			80	2.9	2.9
East Patchogue			107	5.2	5.2
Brookhaven			97	6.2	6.2
Village of Bellport			24	2.3	2.3
Mastic Beach	5	.2	986	33.8	34.0
Mastic			32	1.2	1.2
Poospatuck Indian Res.			7	.2	.2
Shirley			130	4.0	4.0
Center Moriches			141	8.1	8.1
East Moriches	2	.1	110	7.4	7.5
Eastport (Brook.)			6	.3	.3
Eastport (S.H.)			6	.3	.3
Eastport Total			12	.6	.6
TOWN OF BROOKHAVEN TOTAL	358	44.1	3,186	237.0	281.1
Remsenberg-Speonk	1	.1	150	18.1	18.2
Westhampton*	342	49.5	90	8.7	58.2
Quiogue			24	3.3	3.3
Village of Westhampton Beach	355	57.9	354	53.2	111.1
Village of Quogue	192	35.6	164	26.9	62.5
East Quogue	54	9.0	409	31.7	40.7
Hampton Bays	41	2.9	265	20.4	23.3
Shinnecock Hills	13	1.0	205	17.9	18.9
Shinnecock Indian Res.			25	0.7	0.7
Village of Southampton	66	14.6	102	21.5	36.1
Water Mill			72	11.3	11.3
Bridgehampton			102	13.9	13.9
Sagaponack	3	.5	125	18.4	18.9
TOWN OF SOUTHAMPTON TOTAL	1,067	171.1	2,093	246.3	417.4
Wainscott			35	6.3	6.3
Village of East Hampton	3	.6	131	24.4	25.0
Amagansett	78	9.8	386	67.4	77.2
Napeague-Hither Hills	127	13.3	232	30.2	43.5
Montauk	36	3.3	98	9.6	10.9
TOWN OF EAST HAMPTON TOTAL	244	27.0	882	135.9	162.9
SUFFOLK COUNTY TOTAL	2,229	$300.7	15,427	$1,256.9	$1,557.8

*Includes unincorporated portion of Westhampton Beach.

TABLE 2-11

Number and Value of Single and Two-Family Residential Structures on the South Shore Barrier Islands of Nassau and Suffolk Counties (in millions of dollars)

Reach	"V" Zone Structures	"V" Value	"A" Zone Structures	"A" Value	Total Value
Atlantic Beach to Point Lookout*	120	11.0	2,588	184.5	195.5
Jones Beach to Captree Island	324	31.3	119	11.2	42.5
Robert Moses to Moriches Inlet (Fire Island)	586	71.0	2,991	348.3	419.3
Westhampton Beach to Shinnecock Inlet (Dune Road)	915	144.4	—	—	144.4
Shinnecock Inlet to Mecox Bay (Southampton)	66	14.6	45	10.2	24.8
Total Barrier Islands	2,011	$272.3	5,743	$554.2	$826.5
% of L.I. residential structures/value in south shore flood hazard zones on barrier islands	86%	87%	15%	20%	27%

*Most of the City of Long Beach is not within the **A** or **V** Zone as mapped by FEMA.

TABLE 2-12

Single and Two-Family Residential Value at Risk in the "V" Zone for South Shore of Long Island (in millions of dollars)

Village or Community	Value
Westhampton Beach	$57.9
Westhampton (unincorporated)*	49.5
Fire Island (Brookhaven)	43.8
Quogue	35.6
Gilgo/Oak Beach	31.3
Fire Island (Islip)	27.2
Southampton	14.6
Napeague/Hither Hills	13.3
Lido Beach/Pt. Lookout	11.0
Amagansett	9.8
East Quogue	9.0
Montauk	3.3
Hampton Bays	2.9
Shinnecock Hills	1.0
East Hampton	.6
Sagaponack	.5
Mastic Beach	.2
Remsenberg/Speonk	.1
East Moriches	.1
TOTAL	$311.7

*Includes unincorporated portion of Westhampton Beach.

TABLE 2-13
Single and Two-Family Residential Value at Risk in the "A" Zone for South Shore of Long Island (in millions of dollars)

Village or Community	Value	Village or Community	Value
Fire Island (Islip)	$190.9	East Quogue	31.7
Woodmere	185.3	Napeague/Hither Hills	30.2
Massapequa	161.0	Island Park (unincorporated)	27.0
Fire Island (Brookhaven)	157.4	West Babylon	27.0
Freeport	141.5	Quogue	26.9
Merrick	116.0	East Hampton	24.4
Oceanside	113.8	Atlantic Beach (unincorporated)	23.1
Lido Beach/Pt. Lookout	96.6	Southampton	21.5
Bellmore	83.7	Valley Stream	20.7
Copiague	83.3	Bay Shore	20.4
Amagansett	67.4	Hampton Bays	20.4
Baldwin	63.3	Sagaponack	18.4
East Massapequa	61.3	Remsenberg/Speonk	18.1
West Islip	60.6	Shinnecock Hills	17.9
Babylon	58.3	West Amityville	14.5
Westhampton Beach	53.2	Atlantic Beach	14.2
Seaford	52.4	Bridgehampton	13.9
Long Beach*	50.6	Islip	13.7
Amityville	48.3	Massapequa Park	13.1
Wantagh	44.5	Bayport	12.1
South Valley Stream	42.9	Water Mill	11.3
Oakdale	41.3	Gilgo/Oak Beach	11.2
Island Park	41.0	Cedarhurst	10.8
East Rockaway	40.0	Remaining South Shore Communities	123.0
Bay Park	34.0	TOTAL	$2720.3
Mastic Beach	33.8		
Lindenhurst	32.4		

*Most of the City of Long Beach is not within the **A** or **V** Zone as mapped by FEMA.

An examination was made of the reduction in the total value at risk lost through this improper delineation of the 100-year floodplain boundary. Tax assessment records for the entire Long Beach barrier island, including the Village of Atlantic Beach, Atlantic Beach (uninc.), City of Long Beach, and Lido/Pt. Lookout show a total structural value of over $800 million dollars after applying the current equalization rate. The value of residential, commercial, industrial, and multi-family structures alone is over $680 million. The structural values at risk calculated for the floodplain as it is currently drawn were only $230 million. Thus, assuming that the entire barrier island should be included within the 100-year floodplain, an additional $450 million would be included in the calculation.

2.6.2.2 Multi-family Structures. A different method was used to determine the number and value of multi-family houses, apartments, and condominiums existing in the **A** and **V** zones. While these buildings could be located on the aerial photographs, there was no indication as to the number of individual housing units contained therein. In addition, the Census data contain no information on the value of these structures, listing only the value of single and two-family residences. It was therefore necessary to use the following procedure:

1. Multi-family homes, apartments, and condominiums were located on the composite storm hazard map.
2. Each parcel was located on the corresponding tax map to determine section, block, and lot number.
3. The county clerk's office in Nassau County and the individual town assessors offices in Suffolk were contacted to determine the type of facility, the size, the number of dwelling units, and the value for each pertinent tax map parcel.
4. The number and value of dwelling units on the ground floor only was determined by **A** and **V** zones, as these are the units most likely to suffer from tidally-induced storm damage.

The number and value of multi-family houses, apartments, and condominiums in the south shore flood hazard zones of Long Island are presented in Table 2-14. It is important to note that these values are based on tax assessment records, and differ from the single-family residential values, which are based on market values. In many cases, the assessed value after equalization is considerably below the market value because it reflects only structural value, and ignores the substantial differences in real estate prices due to location. Under this system, two buildings constructed identically within a given township would be assessed identically. But if one building was located on the waterfront and the other was not, the waterfront building would likely have a much greater market value. Nevertheless, market value information was unavailable for these structures, and tax assessment records are the most reliable data source for use within the time constraints of this study.

The total value of multi-family structures on Long Island's south shore floodplain is $61.6 million. Structures worth over $39 million are located in Nassau County. Of the $61.6 million total, approximately a third, or over $20 million is located in the high hazard **V** zone. All of these units are located either at Lido Beach/Pt. Lookout in Nassau County, or along the Westhampton Beach portion of the Town of Southampton in Suffolk. Those communities with a significant value of multi-family structures in the **A** zone include the Village of Freeport and the Town of Islip.

2.6.3 Commercial and Industrial Structures. A simple structure count, as used for houses, would not be appropriate for commercial and industrial structures. The diversity of size of the facilities, ranging from small refreshment stands to large shopping centers, would be lost in a simple **head count.** Instead, these facilities are inventoried by total floor space, a figure more representative of the value at risk.

The same methodology was used for both Nassau and Suffolk Counties:

1. The composite storm hazard maps, containing the aerial photographs, floodplain boundaries, land use information, and Census tracts were used as the basic reference source.
2. Each commercial and industrial facility noted on the aerials was located on the appropriate tax map, and section, block, and lot numbers were recorded.
3. Using the section, block and lot numbers, the tax assessment records of each property and structure were examined. Tax assessor records denote location, type of facility, square footage of the property, square footage of the structure, and assessed value.
4. Ground floor square footage and value were recorded for each commercial or industrial facility identified on the aerial photographs, and aggregated by county, town, village and place using Census tract boundaries.

While the Census Bureau publishes detailed information on residential structural value, there is no comparable information available for commercial or industrial structures. The best source of information available regarding the value of commercial and industrial structures is tax assessment records which contain the assessed valuation of both the land and structures thereon. Nassau County tax assessments are stated in 1939 dollars, while each Suffolk County town keys assessments to different years. To convert to current values, it was necessary to apply an equalization rate, different for each town, which should yield current (1983) values.

TABLE 2-14

Number and Value of Multi-Family Residential Structures in the South Shore Flood Hazard Zones of Long Island (in millions of dollars)

Community or Municipality	"V" Zone Dwelling Units	"V" Value	"A" Zone Dwelling Units	"A" Value	Total Value
Village of Cedarhurst			10	.38	.38
Inwood			40	1.06	1.06
Village of Atlantic Beach			6	.30	.30
Woodmere			5	.08	.08
City of Long Beach			7	.38	.38
Bay Park			15	.19	.19
Village of East Rockaway			16	.56	.56
Village of Island Park			59	1.33	1.33
Island Park (unincorporated)			9	.24	.24
Oceanside			125	3.47	3.47
Lido-Pt. Lookout	378	14.2	48	1.05	15.25
Baldwin			17	.48	.48
Village of Freeport			341	9.43	9.43
Merrick			85	3.90	3.90
Bellmore			3	.11	.11
Seaford			74	1.82	1.82
Massapequa			2	.13	.13
Nassau County Total	378	$14.2	862	$24.91	$39.11
Town of Islip			157	8.62	8.62
Town of Southampton	107	6.11	51	2.99	9.10
Town of East Hampton			266	4.77	4.77
Suffolk County Total	107	$6.11	474	$16.38	$22.49
Long Island Total	485	$20.31	1,336	$41.29	$61.60

The assessed value is used for taxation purposes, and does not represent the full market value of structures. Furthermore, the value of a structure is assessed only on initial construction or significant reconstruction. Although all assessments are based on a constant dollar rate updated to current values, it is still suspected that most of the structures inventoried are assessed at significantly below their current market value.

The total value of commercial and industrial structures in the south shore **A** and **V** zones of Long Island is approximately $140 million. This figure, although substantial, is relatively insignificant in light of the $3 billion at risk in the residential sector. Commercial and industrial structures represent less than five percent of the total value at risk in Long Island's south shore floodplain.

Tables 2-15 and 2-16 present the square footage and value of commercial and industrial structures in the south shore floodplain of Nassau and Suffolk Counties. In Nassau County, commercial structures in the **A** zone are valued at $68.9 million; there are no commercial buildings in the **V** zone. In addition, there are $38 million worth of industrial structures in the **A** zone. The communities with the most significant holdings include the Village of Freeport, with $15 million each in the commercial and industrial categories. Oceanside has $11 million of commercial structures and over $17 million of industrial structures. Woodmere has $14.5 million of commercial structures.

Suffolk County has a considerably smaller value at risk in the commercial and industrial sectors than Nassau. There are approximately $32 million worth of commercial structures at risk in the flood zones, $1.6 million of which is in the **V** zone. There are relatively few industrial structures in the Suffolk County south shore floodplain, representing a value of less than one million dollars.

In addition, there are a number of oil storage facilities located in Nassau County which are not represented in this inventory. These facilities are discussed separately in section 2.6.6. It is important to note that compared to the 1 million gallons of petroleum product storage capacity in the Suffolk floodplain, there are almost 90 million gallons in Nassau's floodplain.

2.6.4 Institutional Structures. The variety of structures included within the institutional classification necessitated a different inventory approach. A lump sum count, as done for residential structures, would incorrectly group all of the various institutional uses together. A quantification of floor space, as done for commercial and industrial structures, would be inappropriate for institutional structures ranging from schools to churches.

Instead, institutional structures were inventoried by community, and quantified by subcategory. The methodology involved in the institutional inventory included:

1. The composite storm hazard maps were used to locate institutional structures.
2. Tax maps were used to determine section, block, and lot numbers of institutional properties.
3. Deed and tax assessment data for each property were examined.
4. The final listing of institutional structures was quantified by subcategory for each municipality and is shown in Table 2-17.

For Long Island as a whole, there are seven schools, 18 churches or temples, and 29 assorted municipal buildings—including fire houses and post offices—in the floodplain.

2.6.5 Marine Commercial Establishments, Boat Slips and Recreational Boats. The marine commercial facilities inventoried include marinas, boat basins, fishing stations, yacht clubs, and boat slips. Municipal boat basins are also included in this tally although they are not included in the marine commercial land use category. Boating Almanac Co., Inc. (1983) and 1980 aerial photographs were the principal data sources for the marine commercial inventory. Table 2-18 summarizes the total number of marine commercial facilities, by municipality, within the floodplain.

Recreational activities on Long Island are intimately associated with the waterfront. It is therefore not surprising to discover that Suffolk County has more registered boats than any other county in New York State; Nassau County has the second greatest number of registered boats in the State.

Records from major storms elsewhere in the country indicate that boat damage associated with hurricanes and northeast storms is often substantial. Data are not available on the number of recreational boats found along the south shore waterfront of Long Island; nor is it possible to predict the percentage of these boats that would be destroyed in a major hurricane. Neverthe-

TABLE 2-15

Floor Space and Value of Commercial and Industrial Structures in the South Shore Flood Hazard Zones of Nassau County*

Municipality	Commercial Structures ("A" Zone) Floor Space (ft^2)	Commercial Structures ("A" Zone) Value ($)	Industrial Structures ("A" Zone) Floor Space (ft^2)	Industrial Structures ("A" Zone) Value ($)
Village of Atlantic Beach	67,050	4,680,000		
Village of Cedarhurst	10,800	150,000		
Village of East Rockaway	40,836	1,710,000		
Village of Freeport	363,160	14,830,000	632,143	15,150,000
Village of Hewlett Harbor	32,878	930,000		
Village of Island Park	72,086	1,860,000	See Oil Storage	300,000
Village of Rockville Centre	9,350	1,060,000		
City of Long Beach**	25,000	790,000		
Unincorporated Areas				
South Valley Stream	23,070	750,000		
Inwood	51,835	1,800,000	56,535	2,500,000
Woodmere	117,500	14,510,000		
Bay Park	13,156	430,000	47,364	890,000
Oceanside	533,987	11,300,000	650,751	17,280,000
Atlantic Beach	92,000	3,000,000		
Baldwin	27,494	1,350,000		120,000
Merrick	42,991	3,080,000		
Bellmore	40,269	1,180,000	12,860	190,000
Seaford	22,308	870,000	8,435	80,000
Island Park	50,640	1,410,000	3,310	1,800,000
Point Lookout/Lido	61,380	2,720,000		
TOWN OF HEMPSTEAD TOTAL	1,697,790	67,620,000	1,411,398	38,310,000
Unincorporated Areas				
Massapequa	9,260	290,000		
West Amityville	15,314	200,000		
TOWN OF OYSTER BAY TOTAL	24,574	490,000		
NASSAU COUNTY	1,722,634	68,900,000	1,411,398	38,310,000

*There are no commercial or industrial structures recorded in the **V** Zone of the south shore of Nassau County

Most of the City of Long Beach is not within the **A or **V** Zone as mapped by FEMA

TABLE 2-16

Floor Space and Value of Commercial and Industrial Structures in the South Shore Flood Hazard Zones of Suffolk County*

Municipality	Commercial Structures ("A" Zone) Floor Space (ft^2)	Commercial Structures ("A" Zone) Value ($)	Commercial Structures ("V" Zone) Floor Space (ft^2)	Commercial Structures ("V" Zone) Value ($)	Industrial Structures ("A" Zone) Floor Space (ft^2)	Industrial Structures ("A" Zone) Value ($)
Village of Amityville	21,406	610,000			17,600	160,000
Village of Lindenhurst	109,600	1,930,000			10,000	100,000
Village of Babylon	45,950	1,090,000				
Unincorporated Areas	247,900	3,970,000				
TOWN OF BABYLON TOTAL	424,856	7,600,000			27,000	260,000
Village of Ocean Beach	24,400	3,000,000				
Village of Saltaire	4,600	180,000				
Unincorporated Areas	381,200	4,360,000			89,000	130,000
TOWN OF ISLIP TOTAL	410,200	7,540,000			89,000	130,000
TOWN OF BROOKHAVEN TOTAL (All Unincorporated Areas)	176,000	4,310,000	9,600			
Village of Westhampton Beach	65,600	3,070,000	6,400	70,000		
Village of Southampton	11,200	780,000				
Unincorporated Areas	109,600	3,700,000	33,600	710,000		
TOWN OF SOUTHAMPTON TOTAL	186,400	7,550,000	40,000	780,000		
TOWN OF EAST HAMPTON TOTAL (All Unincorporated Areas)	99,200	3,610,000	22,400	820,000		
SUFFOLK COUNTY TOTAL	1,296,656	30,610,000	72,000	1,500,000	116,600	390,000

*There are no industrial structures recorded in the **V** Zone of the south shore of Suffolk County.

TABLE 2-17

Institutional Structures in the South Shore Flood Hazard Zones of Long Island

Municipality	Structures
NASSAU COUNTY	
Town of Hempstead	
South Valley Stream	1 school, 2 municipal buildings
Inwood	1 child care center, public housing facility, LILCO natural gas storage facility
Bay Park	1 minicipal building
Village of Rockville Centre	1 municipal building
Oceanside	2 LIRR stations, LILCO power plant, 1 school, 2 fraternal organizations, 3 municipal buildings
Baldwin	LILCO storage
Village of Freeport	Municipal stadium, 1 school, 2 municipal buildings, 2 fraternal organizations
Merrick	1 temple
Seaford	1 fire station
Village of Island Park	1 school, 4 municipal buildings, 1 church, 1 post office, 1 fraternal organization
Point Lookout/Lido	1 municipal building, 2 churches, 1 fire station
Village of Atlantic Beach	1 municipal building, 1 Coast Guard station, 1 Town beach club
City of Long Beach	2 churches, 2 schools, 1 fire station
Town of Oyster Bay	
Massapequa	1 municipal building
West Amityville	1 temple
SUFFOLK COUNTY	
Town of Babylon	1 Coast Guard station, 2 municipal buildings
Town of Islip	7 churches, 1 school, 3 fire stations
Town of Brookhaven	4 churches, 3 fire stations, 1 Indian Reservation
Town of Southampton	1 Indian Reservation, 1 Coast Guard station
Town of East Hampton	1 fire station

less, an attempt was made, using available data, to determine the value of boats at risk along the south shore floodplain in the event of a major hurricane.

The New York State Department of Motor Vehicles maintains data on motor vehicle and boat registrations in the State. Data are available on the number of boats in each of five size classes, for every county in 1982. The data also contains information on the distribution of boats by category within each size class at the state level, but not at the individual county level. The categories listed are outboard, inboard, inboard/outboard, sail, and others. The five size classes include under 16 ft, 16-25 ft, 26-39 ft, 40-65 ft, and over 65 ft.

Assuming a similar distribution by categories within size class at the county level as at the state level, the state data was used to determine the probable distribution on Long Island. It is possible that the distribution within size classes at the state level does not accurately reflect the distribution in Nassau and Suffolk Counties. For example, there may be more sailboats on Long Island than the State distributions would indicate; however, there are no methods to accurately assess this situation. Therefore, the State distributions were used as a template for Long Island distributions.

The average value of different types of boats within different size classes is published annually by the National Marine Manufacturers Ass'n. (1983). These values represent the current average unit cost for the different categories of boats throughout the United States. Applying these values to the distribution of boats by size and category on Long Island, the most likely value of all boats on Long Island was determined.

The available data do not illustrate the distribution of boats by either size or category between the north shore and south shore of Long Island. For all of Long Island, the total value of all registered boats is approximately $800 million. Assuming that at least half of these boats are located along the south shore, there are more than $400 million worth of boats in south shore waters. Exactly how many of these boats would be destroyed in a major hurricane depends on the warning time available before the storm, the direction of and intensity of the storm, the number of protected mooring sites, and the number of boats that could be moved by trailer. In any case, the value of boats damaged or destroyed in a major storm would likely be substantial.

TABLE 2-18

Marine Commercial Facility Counts Within the South Shore Flood Hazard Zones of Long Island

Municipality	Marine Commercial Establishments	Boat Slips
NASSAU COUNTY	96	7,018
Town of Hempstead	91	6,561
Village of Lawrence	2	140
City of Long Beach	1	85
Village of East Rockaway	9	214
Village of Island Park	6	583
Village of Freeport	27	1,728
Unincorporated areas		
Oceanside	10	747
Point Lookout	4	394
Baldwin	4	111
LISPC–Jones Beach	1	50
Merrick	6	678
Wantagh	1	136
Bellmore	4	169
Seaford	15	1,469
Inwood	1	57
Town of Oyster Bay	5	457
Unincorporated areas		
South Oyster Bay Township	2	325
Massapequa	3	132
SUFFOLK COUNTY	142	9,943
Town of Babylon	29	2,334
Village of Amityville	5	208
Village of Lindenhurst	7	1,447
Village of Babylon	7	175
Unincorporated areas		
Copiague	5	252
West Babylon	2	135
Gilgo Beach	1	55
Cedar Beach	2	62
Town of Islip	38	2,793
Village of Brightwaters	1	200
Unincorporated areas		
West Islip	1	134
Bay Shore	11	644
Islip	3	90
East Islip	2	335
Great River	2	155
Oakdale	4	363
West Sayville	2	159
Sayville	8	284
Bayport	3	309
Captree State Park	1	120
Town of Brookhaven	43	3,446
Village of Patchogue	7	908
Village of Bellport	1	50
Unincorporated areas		
Blue Point	3	370
East Patchogue	2	150
Brookhaven	1	65
Mastic Beach	3	187
Center Moriches	4	167
East Moriches	14	900
Eastport	1	100
Ocean Bay Park	2	40
Fire Island Pines	1	4
Davis Park	1	234
Fire Island National Seashore	2	186
Great Gun Beach	1	85
Town of Southampton	32	1,370
Village of Westhampton Beach	4	183
Village of Southampton	2	24
Unincorporated areas		
Speonk	1	130
Remsenberg	1	
Westhampton	1	32
East Quogue	1	40
Hampton Bays	22	961
BI-COUNTY TOTAL	238	16,961

2.6.6 Hazardous Material Storage Facilities and Sites. Major hazardous material storage facilities in the floodplain zones on the south shore of Long Island are identified in Table 2-19. A total of 11 petroleum product storage facility sites, one natural gas storage facility, 13 sewage treatment plants, two active landfills and three municipal incinerators have been inventoried. Information on the location and capacity of hazardous materials storage facilities was obtained from the *Nassau County Fire Marshal's Office* (petroleum storage facilities in Nassau County), *Nassau County Health Dept.* (sewage treatment plants (STPs) in Nassau County), *N.Y.S. Dept. of Environmental Conservation* (landfills on Long Island), *Suffolk County Dept. of Health Services* (STPs in Suffolk County), and *LILCO* (power plants and natural gas facilities).

TABLE 2-19

Hazardous Materials Storage Facilities

Petroleum Product Storage Facilities	Location	Storage Capacity (millions of gallons)
Wechter Petroleum	1 Sheridan Blvd., Inwood	1.5
Southville Industries	180 Roger Ave., Inwood	1.5
Shell Oil Corp.	20 Roger Ave., Inwood	2.4
Mobil Oil Corp.	464 Doughty Blvd., Inwood	16.2
Amoco Oil Corp.	555 Doughty Blvd., Inwood	1.1
Carbo Oil Corp.	1 Bay Blvd., Inwood	2.4
Paragon Oil/Texaco	East Ave., Meadowmere Park	11.1
Sun Oil Co.	Hampton Rd., Oceanside	5.1
Gulf Oil Corp.	Hampton Rd., Oceanside	4.3
B.P. Oil Co.	Hampton Rd., Oceanside	3.0
Exxon Inc.	Daly Blvd., Oceanside	3.4
Cirillo Bros.	Washington Ave., Island Park	15.8
LILCO	Long Beach Rd., Island Park	20.2
Freeport Power Plant	298 Buffalo Ave., Freeport	1.5
Marran & Sons, Inc.	102 Mulford St., Patchogue	1.0

TABLE 2-19 (cont'd.)

Natural Gas Storage Facilities	Location	Storage Capacity (millions of cubic feet)
LILCO Gas Storage Holder	Sheridan Blvd., Inwood	6.0

Sewage Treatment Plants (STP)	Location	Capacity (MGD)
West Long Beach	2150 Bay Blvd., Atlantic Beach	0.67
Lawrence	Doughty Blvd., Lawrence	0.97
Inwood	Bay Blvd., Inwood	1.70
Cedarhurst	Peninsula Blvd., Cedarhurst	0.97
Bay Park	4th Street, East Rockaway	63.60
Long Beach	National Blvd., Long Beach	6.21
Cedar Creek	Merrick Rd., Wantagh	29.60
Jones Beach	Jones Beach State Park	1.00
Southwest Sewer Dist.	Bergen Ave., Babylon	30.50
Ocean Beach	940 Bay Walk, Ocean Beach	0.50
Patchogue	Hammond St., Patchogue	0.50
Watergate Apts.	33 Midship Lane, Patchogue	0.23
Yardarm Condominiums	Dune Road, Westhampton Beach	0.10

Landfills	Location	Acreage
Oceanside	East of Long Beach Rd.	approx. 150
Merrick	East of Meadowbrook Pkwy.	approx. 50

Incenerators	Location
Merrick	East of Meadowbrook Pkwy.
Saltaire	Beacon Walk, Saltaire
Ocean Beach	Bay Walk, Ocean Beach

2.7 POPULATION AT RISK IN FLOOD HAZARD ZONES

The population at risk represents the number of persons residing within the south shore **A** and **V** flood hazard zones. An estimation has been made both of the year-round population at risk in the flood hazard zones, and the seasonal population present during the hurricane-susceptible summer months. The year-round and seasonal populations at risk in the south shore flood hazard zones were calculated from the residential structure inventory and 1980 Census data. The Census block statistics do not contain information on seasonal population or dwelling units; this information is available only at the Census tract level. Therefore, it was necessary to use different methods in the determination of year-round and seasonal population. There is also no reliable method to segregate seasonal population into **A** or **V** zones. Seasonal population presented at the municipality and CDP-level therefore represents the 100-year floodplain as a whole, with the **A** and **V** zone populations aggregated.

The results of these calculations are presented in Tables 2-20 through 2-24. Table 2-20 lists the population in the south shore flood hazard zones of Nassau County. There are a total of 74,879 year-round residents in the 100-year floodplain of Nassau County and an additional 750 seasonal residents, yielding a total population at risk in the floodplain during the summer months of 75,629. Table 2-21 sequentially orders the Nassau communities based on total population at risk. Freeport, Massapequa, Oceanside and Woodmere, respectively, have the greatest year-round floodplain population at risk.

Suffolk County's floodplain population at risk is presented in Tables 2-22 to 2-24. Table 2-22 lists the year-round and seasonal populations for all south shore Suffolk County communities running west to east (from Amityville to Montauk). There are 34,818 Suffolk County year-round residents in the floodplain, and an additional 34,344 seasonal residents, yielding a total summer population at risk of 69,162. Table 2-23 reorders the Suffolk County communities to illustrate those with the greatest year-round population at risk. These include Copiague, the Villages of Babylon and Lindenhurst, and West Islip. Table 2-24 presents a ranking of the communities with the greatest seasonal population at risk. More than half of Suffolk County's entire seasonal population at risk is located in Fire Island communities. Adding the seasonal component to the year-round population, Fire

TABLE 2-20

Population in the South Shore Flood Hazard Zones of Nassau County

Community or Municipality	Year-round Population	Additional Seasonal Population	Total of Year-round and Seasonal Population
Town of Hempstead	58,249	558	58,807
Village of Cedarhurst	651		651
Inwood	240		240
Village of Atlantic Beach	342	71	413
Atlantic Beach (unincorporated)	794	22	816
South Valley Stream	1,689		1,689
Village of Lawrence	103		103
Woodmere	6,069		6,069
Village of Woodsburgh	7		7
Village of Valley Stream	1,017		1,017
Village of Hewlett Neck	17		17
Village of Hewlett Harbor	31		31
Bay Park	2,093		2,093
Village of East Rockaway	2,178		2,178
Village of Island Park	4,021		4,021
Island Park (unincorporated)	1,396		1,396
Oceanside	6,820		6,820
Village of Rockville Centre	23		23
Lido-Pt. Lookout	3,478	465	3,943
Baldwin	3,759		3,759
Village of Freeport	9,612		9,612
Merrick	4,291		4,291
Bellmore	3,194		3,194
Wantagh	2,853		2,853
Seaford	3,570		3,570
City of Long Beach*	3,018	192	3,210
Town of Oyster Bay	13,612		13,612
Massapequa	8,966		8,966
Village of Massapequa Park	436		436
East Massapequa	3,272		3,272
West Amityville	938		938
Nassau County Total	74,879	750	75,629

*Most of the City of Long Beach is not within the **A** or **V** Zone as mapped by FEMA.

TABLE 2-21

Year-round Population at Risk in "A" and "V" Zones
South Shore of Nassau County

Village or Community	Population	Village or Community	Population
Freeport	9,612	Island Park (unincorporated)	1,396
Massapequa	8,966	Valley Stream	1,017
Oceanside	6,820	West Amityville	938
Woodmere	6,069	Atlantic Beach (unincorporated)	794
Merrick	4,291	Cedarhurst	651
Island Park	4,021	Massapequa Park	436
Baldwin	3,759	Atlantic Beach	342
Seaford	3,570	Inwood	240
Lido Beach/Pt. Lookout	3,478	Lawrence	103
East Massapequa	3,272	Hewlett Harbor	31
Bellmore	3,194	Rockville Centre	23
Long Beach*	3,018	Hewlett Neck	17
Wantagh	2,853	Woodsburgh	7
East Rockaway	2,178	TOTAL	74,878
Bay Park	2,093		
South Valley Stream	1,689		

*Most of the City of Long Beach is not within the **A** or **V** Zone as mapped by FEMA.

TABLE 2-22

Population in the South Shore Flood Hazard Zones of Suffolk County

Community or Municipality	Year-round Population	Additional Seasonal Population	Total of Year-round and Seasonal Population
Town of Babylon	16,806	1,353	18,159
Village of Amityville	2,369		2,369
Copiague	6,109		6,109
Village of Lindenhurst	2,709		2,709
West Babylon	2,129		2,129
Gilgo/Oak Beach	418	1,353	1,771
Village of Babylon	3,072		3,072
Town of Islip	8,595	19,970	28,565
West Islip	2,449		2,449
West Bay Shore	237		237
Fire Island (Islip)	—		—
Fire Island (Brookhaven)	—		—
Fire Island Total	509	19,970	20,479
Village of Brightwaters	219		219
Bay Shore	1,098		1,098
Islip	402		402
East Islip	297		297
Great River	57		57
Oakdale	2,239		2,239
West Sayville	132		132
Bayport	644		644
Sayville	312		312
Town of East Hampton	864	2,742	3,606
Wainscott	76	30	106
Village of East Hampton	109	317	426
Amagansett	167	1,350	1,517
Napeague-Hither Hills	146	936	1,082
Montauk	366	109	475
Town of Brookhaven	4,548	1,051	5,599
Blue Point	410		410
Village of Patchogue	239		239
East Patchogue	312		312
Brookhaven	269	26	295
Village of Bellport	66		66
Mastic Beach	2,036	862	2,898
Mastic	96		96
Poospatuck Indian Res.	31		31
Shirley	430	37	467
Center Moriches	369	73	442
East Moriches	262	53	315
Eastport (Brookhaven)	—		—
Eastport (Southampton)	—		—
Eastport Total	28		28
Town of Southampton	4,005	9,228	13,233
Remsenberg-Speonk	328	73	442
Westhampton*	193	2,815	3,008
Quiogue	83		83
Village of Westhampton Beach	421	2,712	3,133
Village of Quogue	222	1,410	1,632
East Quogue	673	571	1,244
Hampton Bays	1,261	281	1,542
Shinnecock Hills	285	365	650
Shinnecock Indian Res.	51		51
Village of Southampton	112	375	487
Water Mill	90	144	234
Bridgehampton	108	221	329
Sagaponack	178	261	439
SUFFOLK COUNTY TOTAL	34,818	34,344	69,162

*Includes unincorporated portion of Westhampton Beach.

TABLE 2-23

Year-round Population at Risk in "A" and "V" Zones
South Shore of Suffolk County

Village or Community	Population
Copiague	6,109
Babylon	3,072
Lindenhurst	2,709
West Islip	2,449
Amityville	2,369
Oakdale	2,239
West Babylon	2,129
Mastic Beach	2,036
Hampton Bays	1,261
Bay Shore	1,098
East Quogue	673
Bayport	644
Fire Island (Islip and Brookhaven)	509
Shirley	430
Westhampton Beach	421
Gilgo/Oak Beach	418
Blue Point	410
Islip	402
Center Moriches	369
Montauk	366
Remsenberg/Speonk	328
Sayville	312
East Patchogue	312
East Islip	297
Shinnecock Hills	285
Brookhaven	269
East Moriches	262
Patchogue	239
West Bay Shore	237
Quogue	222
Brightwaters	219
Westhampton (unincorporated)*	193
Sagaponack	178
Amagansett	167
Napeague/Hither Hills	146
West Sayville	132
Southampton	112
East Hampton	109
Bridgehampton	108
Mastic	96
Water Mill	90
Quiogue	83
Wainscott	76
Bellport	66
Great River	57
Shinnecock Indian Res.	51
Poospatuck Indian Res.	31
Eastport	28
TOTAL	34,818

*Includes unincorporated portion of Westhampton Beach.

Island again outnumbers all other Suffolk County communities, with 20,479 persons at risk during the summer months. This figure represents nearly a third of all Suffolk County residents in the floodplain during the hurricane-prone summer months.

The total year-round population at risk within the Nassau and Suffolk south shore **A** and **V** zones is approximately 110,000 people. During the summer months, there are an additional 34,000 people present and at risk in the bi-county south shore floodplain.

TABLE 2-24

Seasonal Population at Risk in "A" and "V" Zones South Shore of Suffolk County

Village or Community	Population
Fire Island (Islip and Brookhaven)	19,970
Westhampton Beach	2,815
Westhampton (unincorporated)*	2,712
Quogue	1,410
Gilgo/Oak Beach	1,353
Amagansett	1,350
Napeague/Hither Hills	936
Mastic Beach	862
East Quogue	571
Southampton	375
Shinnecock Hills	365
East Hampton	317
Hampton Bays	281
Sagaponack	261
Bridgehampton	221
Water Mill	144
Montauk	109
Center Moriches	73
Remsenberg/Speonk	73
East Moriches	53
Shirley	37
Wainscott	30
Brookhaven	26
TOTAL	34,344

*Includes unincorporated portion of Westhampton Beach.

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Chapter 3....

Strategies and Recommendations by Coastal Reach and Detailed Study Area

3.0 INTRODUCTION

This chapter presents strategies and recommendations by coastal reach and detailed study area. They have been formulated to mitigate damage caused by severe storms. Some should be used over the short-term to guide/control incremental development in the floodplain as it occurs; other recommendations are targeted for use after a major storm disaster in hazard areas that have essentially been **wiped clean** of development. In the latter context, the recommendations pertain to the redevelopment process.

The strategies listed for each reach include recommendations in the areas of erosion and flood control, land use and development patterns, land acquisition strategies, environmental regulations, the NFIP and federal policies, and evacuation, warning and public education. These strategies were developed in response to concerns voiced in interviews with community representatives and government officals, and problems identified during LIRPB staff site visits. Several of the objectives and strategies for each reach have been stated previously in various regional plans, including the *New York Coastal Management Plan* (LIRPB, 1979) and the *Long Island 208 Waste Treatment Management Plan* (LIRPB, 1978).

An effort was made to identify geographically specific strategies and recommendations for each reach. However, many of the strategies developed were found to be applicable to all coastal reaches in the south shore floodplain. For example, a strategy to protect and maintain dunes and beaches as natural protective features applies to all of the coastal reaches except the mainland shoreline. Likewise, suggestions regarding modifications in the NFIP and the New York State Uniform Fire Prevention and Building Code will apply equally to all reaches. Suggested modifications to government programs are included in Chapter 4.

Other strategies applicable to all flood hazard zones include the need for communities to adopt provisions for instituting temporary development moratoria in the **A** and **V** zones during the post-storm period. Such moratoria will allow communities to temper the immediate post-storm desire to rebuild structures as quickly as possible (often in the same location) and give them time to implement redevelopment plans. Another strategy which is applicable to all coastal reaches is the need to examine alternative acquisition strategies for selected areas, such as payment of flood insurance claims to full coverage limits, restrictive easements, land exchanges and donations.

3.1 STUDY AREA SELECTION PROCEDURE

In developing a hurricane damage mitigation plan for Long Island's south shore, an area that encompasses more than 500 miles of bay and ocean coastline, the LIRPB was faced with the problem of limiting the scope of the areas to be studied. A detailed, parcel-specific plan for the entire south shore coastline was clearly not feasible, given the financial and time constraints of this study. On the other hand, a general policy document for the south shore would fail to accomplish a key study objective: application of damage mitigation planning at the local level. Such a document would be no more than a listing of generic policies and strategies, without the details and guidelines needed for local implementation.

The method that was selected by the LIRPB staff combines both of the above approaches. Recommendations have been prepared for two levels of investigation: coastal reaches and detailed study areas. Coastal reaches are discrete coastal segments affected by similar coastal processes, land use, and development patterns. Dividing the south shore into a number of separate reaches enables the preparation of policies and implementation strategies tailored to the individual characteristics of that reach, irrespective of political boundaries.

Detailed study areas are smaller, specific areas within the coastal reaches that typify the characteristics and most severe flooding problems of the reach. In this respect, they represent a **worst case** example of the types of problems encountered in each reach. The mitigation policies and implementation strategies developed for each reach were applied on a site specific basis in each of the detailed study areas as an example of local damage mitigation planning. Implementation actions at the Federal, State or local levels are illustrated.

Detailed study areas were selected for in-depth analysis for two reasons. First, as indicated above, they represent an opportunity to highlight and give special attention to areas with particularly severe flooding, erosion or other identified management problems. Second, these detailed study areas represent prototype or case studies which serve to illustrate how the information and recommendations developed in this study can be utilized by localities to develop their own mitigation planning efforts.

3.1.1 Development of Criteria. During the process of interviews with local officials undertaken in July and August, 1983 it became apparent that particular geographic areas face similar flooding and erosion problems based in part on shoreline characteristics and land uses in the flood hazard zones. In particular, storm damage is most likely to occur in developed areas where there are:

- severe or chronic flooding problems
- structures exposed to direct high energy wave attack
- densely developed areas
- patterns of recurring flood insurance claims.

A review of current land uses indicated that certain areas could be differentiated. The Long Beach barrier island, for example, is characterized principally by high and medium density residential land use, whereas the Jones Beach barrier island is primarily recreational in nature. Such similarities within shoreline reaches (as well as differences) help to facilitate the analysis of storm-induced flooding and the formulation of mitigation alternatives.

The identification of general criteria to be used in the delineation of reaches is accomplished by an analysis of natural and man-made systems and their interaction. The criteria include the following:

1. NATURAL RESOURCE CHARACTERISTICS. Elements to be considered include natural buffers and protective features, such as bluffs, dunes and tidal wetlands, along with erosion-stabilizing features, such as maritime flora and gradual slopes.
2. EROSION RATES. The severity of erosion as evidenced by annual rates, or the existence of severely eroding areas that would pose a significant threat to life and/or property in the event of a major storm are two factors to consider.
3. FLOOD HAZARD ZONE LOCATION. A significant amount of land area within the **A** and **V** flood hazard zones is an important criterion. Furthermore, an area that is primarily in the **V** zone will require different management and mitigation strategies than an area in the **A** zone.

4. SHORELINE CHARACTERISTICS. The presence (or lack of) natural features that serve to protect shoreline development during severe storms is an important consideration. The nature of the area's shoreline, whether engineered (e.g., an area where structural measures, such as groins, jetties, bulkheads, etc., have been utilized to control erosion and build up beaches), or natural (e.g., a natural beach and dune system with no disruption of normal sand transport patterns along the shore) is another.
5. LAND USE CHARACTERISTICS. The presence of similar land uses and intensities of use in an area is a criterion, especially if the location of these land uses leaves them vulnerable to storm-induced damage, by virtue of their low elevation or proximity to the shore. Furthermore, if a majority of the development in an area pre-dates the adoption of floodplain management regulations, the area needs special attention to safeguard structures that do not conform to NFIP or floodplain management regulations. Another consideration is whether or not residences are primary or secondary. If secondary (e.g., summer or vacation homes), there is less urgency to protect them compared to year-round homes. Finally, the existence of significant tracts of vacant, developable land in the floodplain is important, because of the additional threat that would be posed if it is developed inappropriately or unwisely.
6. SPECIAL EMERGENCY MANAGEMENT PROBLEMS. The presence of problems with respect to transportation, evacuation and localized instances of flooding is a criterion. For example, some areas will have different evacuation capabilities and be easier to evacuate than others, based on available transportation routes, facilities and emergency equipment. Areas will also be at different states of preparedness, depending on the status of emergency planning efforts.

   A history of documented flooding problems in an area or a history of frequent flood insurance claims would indicate the need for special attention. Finally, the presence of significant amounts of stored hazardous materials, landfills or sewage treatment plants that could create environmental hazards in the event of storm-induced flooding would also indicate the need for special attention.
7. FLOODPLAIN MANAGEMENT JURISDICTION. One criterion is the presence of governmental jurisdictions in an area with sufficient powers to implement plan recommendations. Another is the presence of overlapping jurisdictions with conflicting or contradictory policies.
8. POPULATION AND STRUCTURES AT RISK. Another important factor is an area's population at risk (i.e., population residing in flood hazard zones), or the special characteristics of the population that make it particularly vulnerable to hurricane-induced damage. For example, an area with a high percentage of elderly or relatively immobile residents would require special consideration if evacuation of those residents was required. Similarly, the value of structures at risk in a flood hazard zone is also important.

3.1.2 Study Area Description. For the purposes of this report, the Long Island south shore was divided into six coastal reaches, using the procedure and criteria described above. Four of the six coincide with the Long Beach, Jones Beach, Fire Island and Westhampton barrier islands. The fifth includes the eastern headlands section and extends from Shinnecock Inlet to Montauk Point, and the sixth includes the mainland bay shoreline, which extends from Brosewere Bay in western Nassau County through Great South Bay, Moriches Bay and Shinnecock Bay in Suffolk County. Detailed study areas were selected within each reach to represent conditions encountered there. The selected coastal reaches, along with their associated detailed study areas, are listed below:

REACH #1: *Long Beach Barrier Island*
DETAILED STUDY AREA: *West Long Beach (City of Long Beach; Town of Hempstead)*

REACH #2: *Jones Beach Barrier Island*
DETAILED STUDY AREA: *Gilgo/Oak Beach (Town of Babylon)*

REACH #3: *Fire Island*
DETAILED STUDY AREA: *Village of Saltaire to Lonelyville (Town of Islip)*

REACH #4: *Westhampton Barrier Island*
DETAILED STUDY AREA: *Westhampton Beach (Town of Southampton)*

REACH #5: *Shinnecock Inlet to Montauk Point*
DETAILED STUDY AREA: *Napeague (Town of East Hampton)*

REACH #6: *Mainland and Bay Island Areas*
DETAILED STUDY AREA: *Mastic Beach (Town of Brookhaven)*

Table 3-1 describes the six coastal reaches in terms of the characteristics or features of the reach selection criteria detailed previously. Fig. 3-1 illustrates the boundaries of the six coastal reaches and serves as a location key for the detailed study areas.

TABLE 3-1

Selected Study Area Characteristics

Reach	Shoreline Characteristics	Predominant Natural Resource Characteristics	Predominant Land Uses	Public or Private Ownership	Characteristics of Population at Risk (Age, Seasonal)	Special Transportation/ Evacuation Problems	Special Flooding Problems	Population Value at Risk (Millions $)	Governmental Jurisdictions
Long Beach	Groins, Jetties, Sand Nourishment.	Developed man-made Dunes; tidal wetlands	**V** Zone-Recreation & Commercial **A** Zone-Commercial, Recreation, Open Space, High Density Resid.	**V** Zone - Public **A** Zone - Private	Densely populated Year-round residents High % elderly	Flooding of bridges and access roads; few evacuation routes	High density development in low lying, flood-prone areas; suspected error in FHZ designation	8,382/$222.6	City of Long Beach Town of Hempstead Village of Atlantic Beach
Jones Beach	Groins at Oak Beach, Beach maintained by nourishment.	Beach, natural dune system; tidal wetlands	**V** Zone-Open Space/Recreation (Active) Medium Density Resid. at Oak & Gilgo Beaches **A** Zone-Open Space Medium Density Resid.	**A** & **V** Zones Public (Private Leases)	Predominantly seasonal; small year-round population	No special problems	Substantial park infrastructure and residential development in V Zone	1,771/$42.5	L.I. State Park Commission Town of Babylon Town of Oyster Bay
Fire Island	Natural Shoreline	Beach, natural dune system; tidal wetlands	**V** Zone-Vacant, Open Space and Recreation **A** Zone-Medium Density Resid. Communities located between Open Space and Recreation	**V** Zone - Public **A** Zone - Public except in developed communities	Very large seasonal; small % year-round	Evacuation depends on ferry service	Location of resid. development in FHZ; erosion & dune migration exacerbate problem	20,479/$419.3	Fire Is. National Seashore Town of Islip Town of Brookhaven Village of Saltaire Village of Ocean Beach

TABLE 3-1 (cont'd.)

Reach	Shoreline Characteristics	Predominant Natural Resource Characteristics	Predominant Land Uses	Public or Private Ownership	Characteristics of Population at Risk (Age, Seasonal)	Special Transportation/ Evacuation Problems	Special Flooding Problems	Population Value at Risk (Millions $)	Governmental Jurisdictions
Westhampton Barrier Island	Natural Shoreline except groins at Westhampton Beach	Beach, natural dune system; tidal wetlands	**V** Zone-Vacant, Open Space and Recreation east of Quogue; Quogue and Westhampton Low and Med. Density Resid. and Commercial	**V** Zone - Public Tiana Beach; Private Quogue to Cupsogue Park	Large seasonal (95%)	Limited bridge capacity, relative of seasonal pop. - Dune Rd. extremely vulnerable to flooding	Severe flooding and erosion west of groins (700 & 800 block Dune Rd.)	4,959/$144.4	Town of Southampton Vill. of Westhampton Village of Quogue
Shinnecock Inlet to Montauk Point	Natural Shoreline Gabions at Montauk Point	Dunes & beach system Shinnecock to Napeague; beach and bluffs Napeague to Montauk	**V** Zone-Open Space Residential near Shinnecock **A** Zone-Open Space near Montauk and Napeague, Low Density Residential (High value) & Vacant	**V** & **A** Zones Public at Montauk, Napeague, and Amagansett; remainder mixed Resid. & Vacant	Large seasonal (75%)	Montauk Hwy. has limited carrying capacity	Potential for overwash at Napeague, thus cutting east end evacuation routes	5,146/$243.8	Town of Southampton Town of East Hampton Vill. of Southampton Vill. of East Hampton
Mainland Hempstead Bay to Shinnecock	Heavily bulkheaded shoreline	Some tidal wetland; predominantly developed	**A** Zone-Medium & Low Density Resid. and Commercial	Predominantly Private	Year-round	None	Areas of resid. development constructed below base flood elevation	122,054/ $2,160.9	6 Towns 16 Villages

3.2 LONG BEACH BARRIER ISLAND: REACH PROBLEMS AND STRATEGIES

Dominated by shore protection structures, such as groins and jetties, Long Beach is an example of a barrier island shoreline which is artificially maintained. Few natural features remain; man-made dunes exist at a few locations and a small tidal wetlands area is found on the bay side of the island. The ocean shoreline is subject to continued erosion, due to the poor condition of the groins, and there is little or no protective buffer along the bay side of this barrier island, as it has been almost entirely bulkheaded.

Long Beach Island is characterized by high density, year-round residential development in low-lying, flood-prone areas. (See Figs. 3-2 and 3-3.) The majority of this development, which includes high rise buildings of up to 10 stories, was built prior to implementation of NFIP construction standards, and is neither floodproofed nor elevated above the base flood level. The low-lying elevation of many of the structures results in a relatively high structural value at risk; there is also a high population at risk due to the density of development.

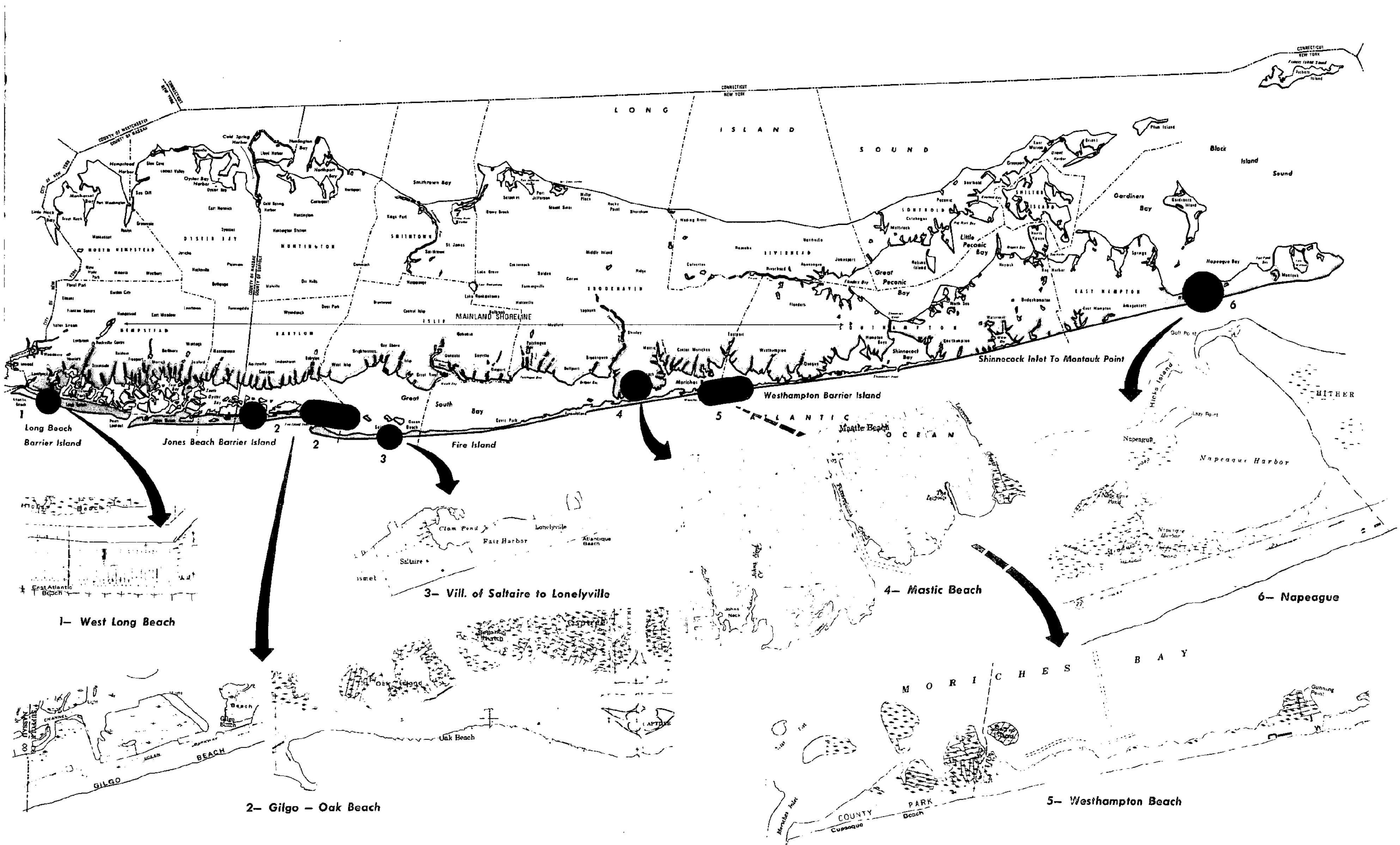
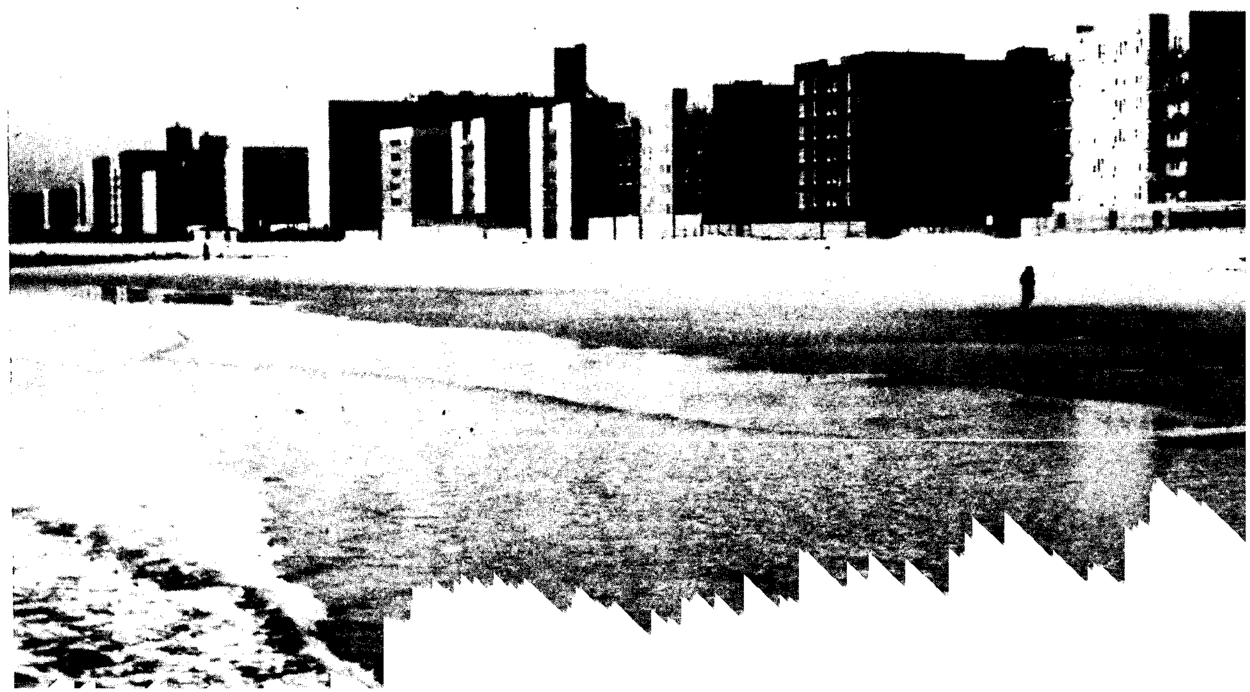


Figure 3-1
Coastal Reaches and Detailed Study Areas of Long Island's South Shore within Nassau and Suffolk Counties

Figure 3-2
Atlantic Beach–
View of boardwalk, high density development, and groins

Figure 3-3
Long Beach–
High density development along the shoreline



One of the key reasons that Long Beach was selected for detailed study was a suspected improper designation in flood hazard zones on the FIRMs used to determine flood insurance rates. Based on U.S. Geological Survey (USGS) topographic maps, it appears that large portions of the City of Long Beach now classified in the FIRM **B** zone, which is considered relatively safe from 100-year storm flooding, are actually at elevations that should place them in the more hazardous **A** or even **V** zone. If this is in fact true, the communities on Long Beach Island would face even more serious problems in the event of a severe storm, since new or rebuilt structures located in **B** zones are not required to be floodproofed or elevated, as are structures in **A** and **V** zones.

A significant portion of this barrier island serves high intensity public recreational uses. Accordingly, there is a substantial public infrastructure investment to be protected. A major problem on Long Beach Island is the difficulty of evacuation due to the flooding vulnerability of its transportation routes. The presence of a large number of elderly residents in high rise apartments and nursing homes situated close to the beachfront will create additional evacuation difficulties. The recommended storm damage mitigation strategies for Long Beach Island are presented in Table 3-2.

3.2.1 West Long Beach Study Area

3.2.1.1 General Description and Problem Statement. The detailed study area includes unincorporated portions of the Town of Hempstead and the westernmost section of the City of Long Beach. It is bounded by the Atlantic Ocean to the south, Reynolds Channel to the north, New York Ave. on the east, and Clayton Ave. on the west. The West Long Beach study area was selected because the area has experienced severe flooding, as evidenced in 1944 when a storm resulted in an overwash from the ocean to the bay. The area also sustained damage in 1938, 1950, 1953, 1960 and 1962. It should be noted that the study area is located on the narrowest portion of Long Beach Island and is not protected by a dune system. The northern shoreline adjacent to Reynolds Channel is completely bulkheaded. In addition to the flooding problems since its development, the area is known to be a prior inlet site, as evidenced on 1913 USGS topographic maps. Based on USGS information, the elevation of the study area is less than 10 ft above msl. The majority of the study area is between 6 and 7 ft above msl. The current FIRMs, which designate this area as outside of the 100-year floodplain, therefore appear to be incorrect.

TABLE 3-2

Long Beach Reach Strategies

EROSION AND FLOOD CONTROL MEASURES

- Maintain the general position and configuration of the ocean shoreline.
- Promote creation and maintenance of dunes and beaches as natural protective features. Protect existing natural dune formations.

LAND USE AND DEVELOPMENT PATTERNS

- Cluster development/redevelopment away from high hazard area.
- Retain and improve existing shorefront recreational use.
- Develop reconstruction plans for the placement of utilities.

LAND ACQUISITIONS STRATEGIES

- Identify specific hazard area parcels adjacent to parks and recreation facilities for post-storm acquisition.

THE NFIP AND FEDERAL POLICIES

- Amend FIRMs and change policy designations where appropriate.
- Do not extend flood insurance coverage to basements within the 100-year flood zone. Deny the Town of Hempstead exception request.

EVACUATION, WARNING AND PUBLIC EDUCATION

- Upgrade access from barrier island to mainland through improvements to bus and train facilities.
- Determine feasibility of vertical evacuation. Seek arrangements with owners of buildings for use as evacuation shelters.

The land use of the area consists of medium to high density residential, with limited commercial development. The residential density is approximately eight dwelling units per acre. Many of the residential structures located in this detailed study area were originally summer residences now converted to year-round occupancy, most of which are neither elevated nor floodproofed. (See Fig. 3-4.) The total structural value at risk of the approximately 2300 houses in this study area is $92 million (based on 1980 Census data).

The streets within the detailed study area have a north/south orientation and, as such, appear to provide a ready conduit for storm surge water to travel between the bay and ocean. This detailed study area is also particularly vulnerable to storm-induced flooding because it is located at the southern terminus of Broad Channel. A substantial ebb flow of the storm surge from Broad Channel would hit the bulkheaded shoreline and, if high enough, could overtop the bulkhead and flow down the streets. Fig. 3-5 shows the boundaries of the West Long Beach study area.

3.2.1.2 West Long Beach Strategies.

- The FIRMs for the study area appear to be incorrect. Based on the uniformly low elevation, lack of protective features such as dunes, and historical flooding patterns, FEMA should update and amend the FIRMs as required.

The configuration of flood zone boundaries on Long Beach Island appear unusual in relation to the other south shore barrier islands. While the Jones, Fire Island and Westhampton Beach barrier islands are entirely within the **A**—if not **V**—zone, a large portion of Long Beach Island is designated as being outside of the 100-year floodplain.

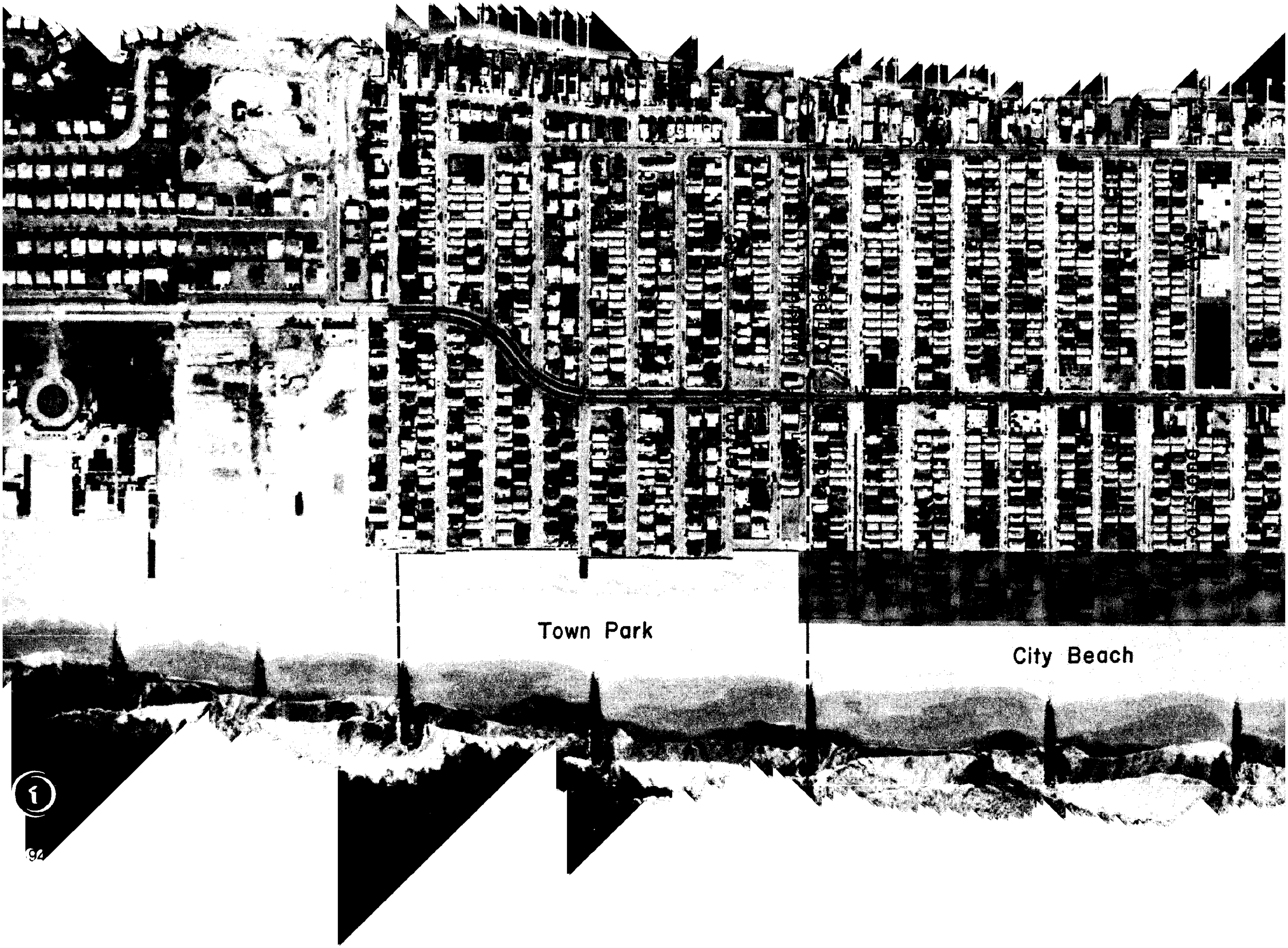
Elevation data was collected for the West Long Beach study area to document the inappropriateness of the flood zone boundaries. While the data presented here is relevant for only a small portion of the barrier island, the LIRPB recommends that FEMA reexamine the entire island, including the Village of Atlantic Beach and the City of Long Beach, and amend FIRMs accordingly.

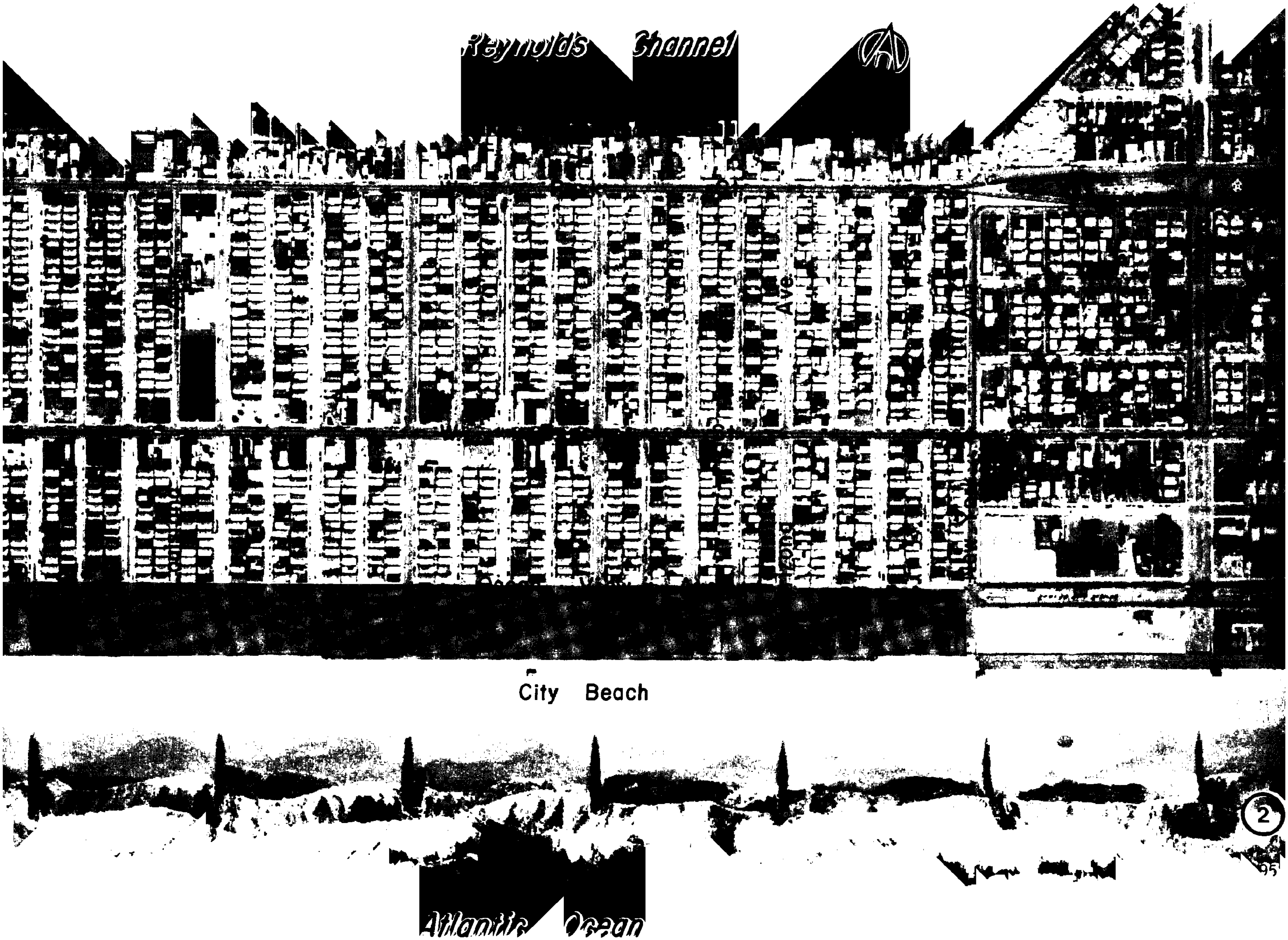
Figure 3-4
W. Long Beach–
High density single and two family housing typifies the area

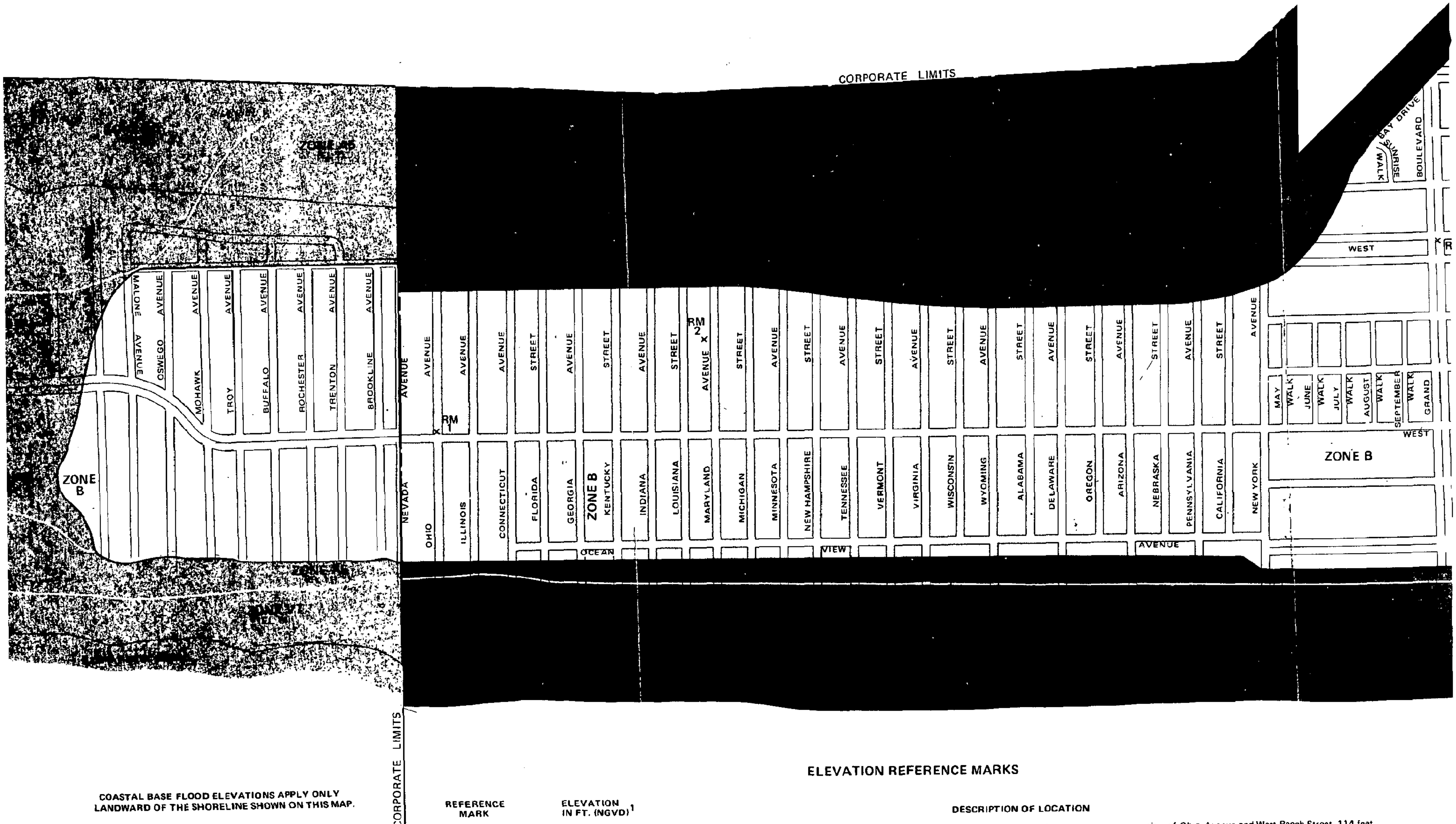
The FIRM for the study area, prepared by FEMA in 1983 (Fig. 3-6), shows the boundary of the **A** and **V** zones, the base flood elevations for each zone, and several reference mark elevations. The base flood elevations (100-year storm) for the **V** zone is noted as 14 ft msl, while 11 ft msl is the **A** zone base flood elevation. The current boundary of the **A** zone ends south of Ocean View Ave. An examination of Figs. 3-7 and 3-8, however, shows the ground elevations throughout the study area to be less than 11 ft, and in most cases no more than 6 or 7 ft. Figure 3-7 is taken from a 1982 sanitary sewer map, prepared for the City of Long Beach, and Fig. 3-8 was prepared in 1934 under the *Works Progress Administration* (WPA) program. The very close correlation of these two maps clearly establishes the elevation of the area. In addition, a site visit to the area revealed the complete lack of any protective dunes which could serve to modify the flood hazard. (See Fig. 3-9.)

KEY AERIAL
— Study Area

W. LONG BEACH


Town Park
City Beach
1


Reynold's Channel
Ave
City Beach
Atlantic Ocean
2



COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORELINE SHOWN ON THIS MAP.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 1	9.918	USC&GS tidal tisk, stamped BM 2 1927, top of 3 foot concrete block incorporated in pavement at intersection of Ohio Avenue and West Beech Street, 114 feet north of curb line of West Beech Street, between houses 60 and 61 Ohio Avenue.
RM 2	8.054	C&GS standard disk, stamped BM 5 1927, top of concrete wall at north end of entrance steps of the Maryland Avenue entrance to West End Grammar School, 0.1 mile north of intersection of West Beech Street and Maryland Avenue.
RM 3	5.643	One and one-half inch outlined square on top of rounded corner of curb, level with sidewalk, 0.3 foot southwest of southwest edge of catch basin at southwest corner of intersection of West Park Avenue and Wyoming Avenue.
RM 4	7.467	Chiseled square on north curb of West Park Avenue in front of light pole, at northwest corner of intersection of West Park Avenue and Grand Boulevard.
RM 5	8.927	Chiseled square on top of curb of West Park Avenue, at northeast corner of intersection of West Park Avenue and Magnolia Boulevard

[1] National Geodetic Vertical Datum of 1929

Figure 3-6

FIRM map for West Long Beach (prepared by FEMA, Dec. 1, 1983)

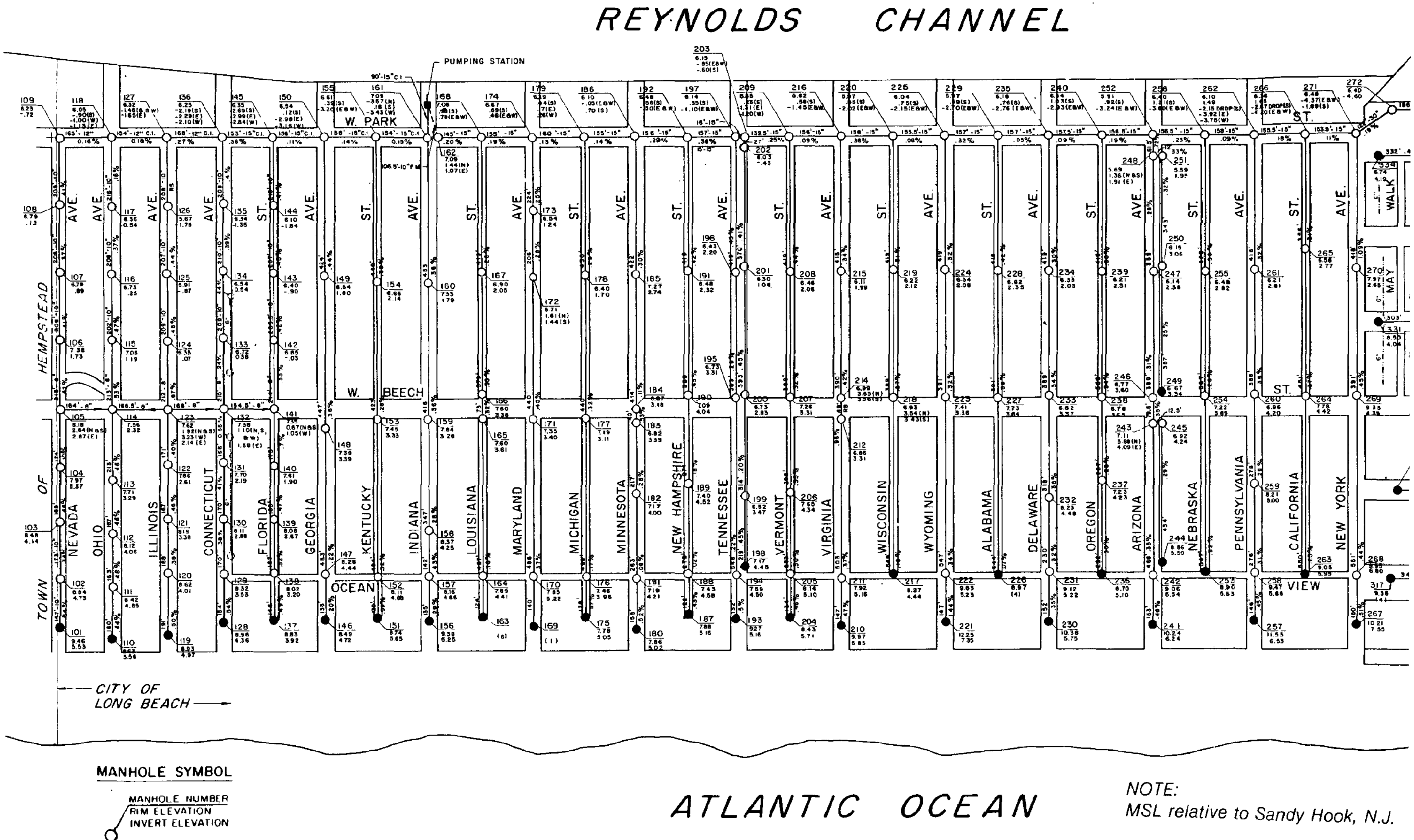
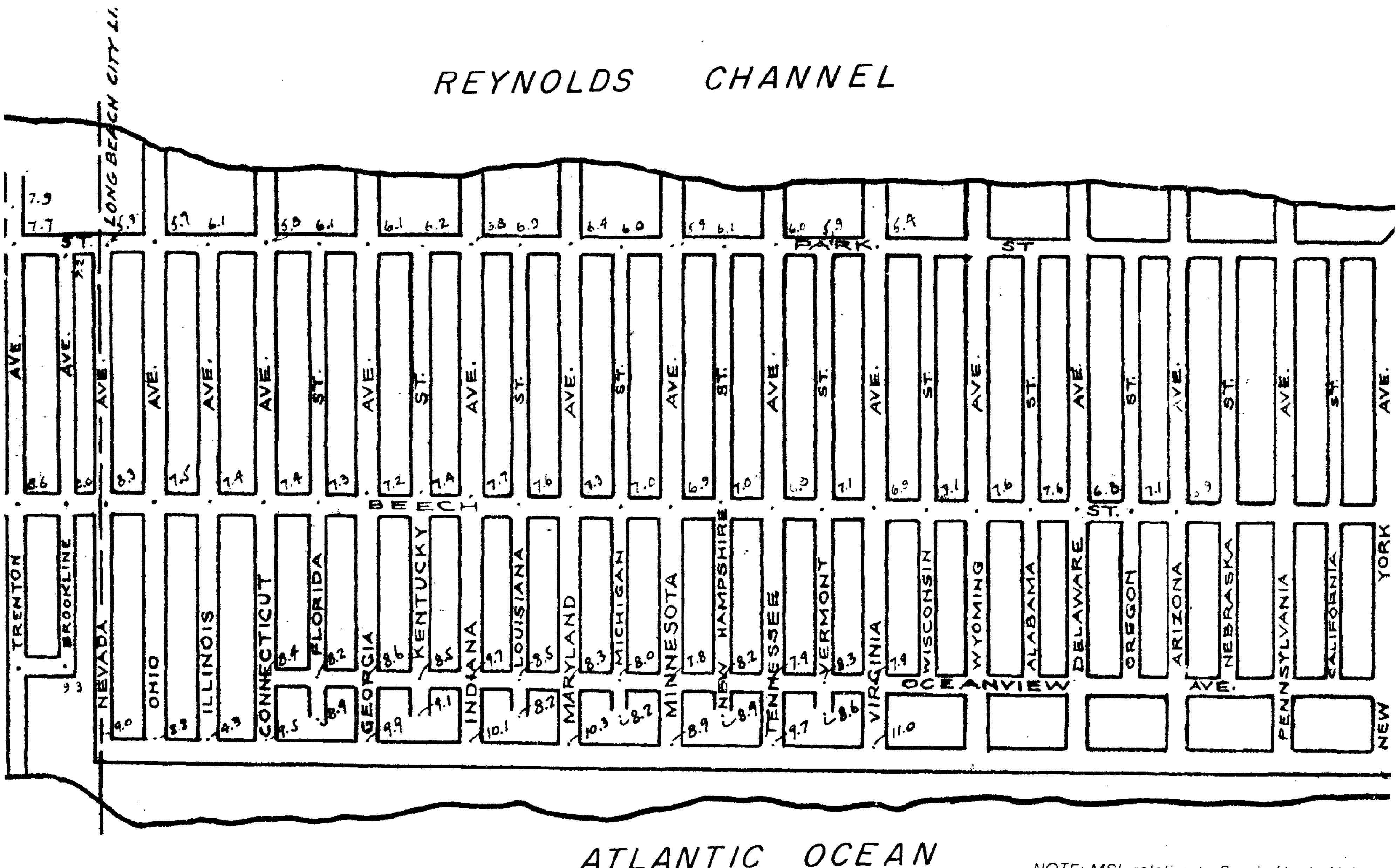


Figure 3-7

A portion of the Sanitary Sewer map for the City of Long Beach (prepared Dec. 1982)



NOTE: MSL relative to Sandy Hook, N.J.

Figure 3-8
A WPA map of West Long Beach showing elevations relative to MSL (prepared Dec. 26, 1934)

Figure 3-9
W. Long Beach–
View of the shoreline showing lack of protective dunes

As further evidence of the flood hazard in this area, a brief history of flood effects since 1938 was prepared. Most of the information presented in Table 3-3 was taken from the series of Topo-Metrics Flood Observation Records prepared for the U.S. Army Corps of Engineers (Topo-Metrics, Inc., undated). Long Beach Island, including the entire area currently designated as outside of the 100-year floodplain, has experienced severe flooding on at least six separate occasions in the past 50 years. Furthermore, none of these storm events approached the magnitude or intensity of the 100-year storm. It is therefore recommended that FEMA remap the flood zone boundaries for the entire barrier island. Designating this area as part of the 100-year floodplain would be accompanied by the associated restrictions, including standards for building elevation and floodproofing, standards for dune protection, and requirements of flood insurance as a prerequisite for new mortgages. The majority of structures within the study area were originally built as summer cottages, which were later converted to year-round usage. They are for the most part neither elevated nor floodproofed. Designating this area as part of the 100-year floodplain would require all new construction, and substantial improvements (over 50% of structural value), to be built to the standards of the NFIP.

Regulations of the NFIP also require that coastal communities with defined **V** zones adopt regulations prohibiting the man-made alteration of sand dunes which would increase potential flood damage. A problem on the Long Beach Island is that dunes in most areas are non-existent, except in the unincorporated areas of the Town of Hempstead where an active program of dune creation and maintenance is ongoing. (See Fig. 3-10.) In contrast, the Village of Atlantic Beach annually spends between $2500 and $5000 to **bulldoze the dunes flat!** FEMA should vigorously enforce the prohibition against dune alteration. Other federal agencies, such as the COE or the Dept. of the Interior, should condition the awarding of grants and funds to coastal communities by requiring the creation and maintenance of protective dune systems.

A related flood insurance issue on Long Beach Island is the requirement of federal flood insurance by banks on federally insured mortgages. The federal program requires banks to demand flood insurance for structures in the **V** and **A** zones—areas of the 100-year flood. A local bank in Long Beach reported that banks there currently require flood insurance policies as a prerequisite for new mortgages in **C** zones, and sometimes in **B** zones as determined by individual appraisal. This would indicate that the banking community on Long Beach island is more cognizant of the flooding threat there, by requiring flood insurance coverage for those structures at locations which FEMA has deemed to be outside of the 500-year floodplain.

- The shoreline should be maintained in its present position. The beach should be maintained through a program of beach nourishment, and the existing groins should be repaired and strengthened.

TABLE 3-3

Hurricane and Storm History of Long Beach Barrier Island Since 1938

1938 Hurricane
- In the East Atlantic Beach area of Long Beach, homes were flooded and a stream of water 2 ft deep linked the ocean with Reynolds Channel.[a]
- On the beachfront near Wyoming and Arizona Avenues, the first floor of houses was flooded with 1 ft of water.[a]
- The first floor of Long Beach Hospital was flooded with 2 ft of water; Long Beach was under water in most places.[a]
- Lido Beach was under water in most places; Lido Blvd. was covered with 1 ft of water.[a]
- Point Lookout was under water in most places and was the hardest hit of the Nassau Beach resorts. Water from the ocean crossed the Town Park and formed a channel to the bay. Lido Blvd. was under 2 ft of water in this area.[a]

1944 Storm
- 11 houses were destroyed south of Ocean View Ave., between Connecticut and New York Avenues.[b]

TABLE 3-3 (cont'd.)

1950 Northeaster
- West Hudson St. at National Blvd. was flooded with 1 ft of water.[c]
- Area surrounding Long Beach Hospital was under 2 ft of water.[c]
- Most of Park Ave. was under 1 ft of water.[c]
- The Lido Canal area was flooded with 1 ft of water.[c]

1960 Hurricane Donna
- Total damages estimated at over $4 million. The maximum tide of record, 8.6 ft, msl, was recorded on the ocean side of Long Beach.[d]
- Waterfront near the Atlantic Bridge was inundated from the bay with 1 ft of water.[e]
- The Lido Canal area of Long Beach was inundated with 1 ft of water.[f]
- Main St. in Lido Beach was under 1 ft of water.[g]
- The LIRR trestle was under 1 ft of water.[g]
- The barrier island was breached, as the ocean came through the access road, across Lido Blvd., and into the marina at Hempstead Town Park.[g]

1962 Northeaster
- The ocean met the bay at Florida St. Most all of Long Beach was under water up to 1 ft deep.[h]
- LIRR trestle to Long Beach was under 2 ft of water.[h]

1984 Northeaster
- Certain oceanfront apartment buildings had 5 ft of water in the lobby.[i]

[a] *Nassau Daily Review* 9/22/38

[b] Nassau County Tax Assessment Records

[c] *Long Beach Life* 11/30/50

[d] NYSDEC, 1976

[e] *New York Times* 9/13/60

[f] *Nassau Herald* 9/16/60

[g] *Newsday* 9/13/60

[h] *Newsday* 3/8/62

[i] *Newsday* 3/30/84

Figure 3-10
Point Lookout–
Illustration of an active dune protection and maintenance program

The entire shoreline of Long Beach Island, from Point Lookout to Atlantic Beach, is artificially maintained through a series of groins, jetties, and beach nourishment. The history of structural shoreline protection is presented in Table 3-4. Beach erosion in this reach has been partially minimized by this structural protection; however, the flooding effects documented in Table 3-3 have still been extensive. Furthermore, the potential for enormous damage from a severe storm remains.

The high density nature of existing development on Long Beach Island precludes a strictly non-structural approach to hurricane damage mitigation. Structural protection measures must be used in combination with certain non-structural approaches to yield a degree of storm safety. Therefore, the LIRPB recommends that the communities of Long Beach Island continue or initiate efforts to protect and maintain the shoreline.

Structural shoreline protection measures need not necessarily take the form of a large construction project, such as the plan proposed by the COE for Long Beach Island in 1965. This multiple purpose beach erosion control and hurricane protection plan featured hurricane barrier gates at the inlet openings, as well as closure levees, groin construction and beach nourishment. The plan was opposed at the time by local interests and dropped from consideration in 1972. A new structural protection plan should be prepared for this reach, at a scale amenable to the local concerns. Such a plan could include a program of groin repair, dune building, beach grass planting, snow fence placement, and other smaller scale measures. For example, the Town of Hempstead has created protective dunes at Point Lookout/Lido Beach through the use of snow fencing, vegetation planting, and the utilization of available dredged material. An 1800 lf protective dune was recently created where none previously existed for a cost of approximately $90,000. These methods of construction may be applicable to other portions of Long Beach Island. The use of special taxing districts for erosion control projects should also be considered.

- In the event of a storm that inflicts damages to structures equal to or exceeding 50% of the structural value, such structures should be relocated to inland locations to allow the extension of the dune line system, which has been artificially created to the west. This dune system should then be maintained to provide a degree of storm protection.

TABLE 3-4

Long Beach Barrier Island: Shoreline Construction History

Project	Date	Description	Area	% Complete	Cost (Reference)
Federal-U.S. Army Corps of Engineers					
1. East Rockaway Inlet Channel Improvement	1930	Dredge channel 12 ft. deep, 250 ft. wide, .6 mile long. Construct 4,250 ft. jetty on eastern side.		100%	$603,969 (a)
2. East Rockaway Inlet to Jones Inlet Beach Erosion Control and Hurricane Protection	1965-proposed 1972-plan dropped	Multiple purpose beach erosion control and hurricane protection plan featuring: hurricane barriers, reconstruct groins, construct new groins and closure levees, and periodic beach nourishment.	10 miles of ocean shoreline	0% project not authorized.	$45,000,000 (b) (proposed)
3. Lido and Long Beach	1962	Emergency Beach rehabilitation project.	4,500 feet ocean shoreline	100%	$260,000 (a)
State and Local					
Atlantic Beach	1954-58	14 Stone Groins, 4 Contracts Total		100%	$2,400,500 (c)
Atlantic Beach	1959-60	Hydraulic Fill of 382,320 cu. yds.		100%	317,172 (c)
East Atlantic Beach	1950-51	2 Stone Groins		100%	207,000 (c)
East Atlantic Beach	1949	Hydraulic Fill		100%	80,599 (c)
Long Beach (West End)	1955	Hydraulic Fill		100%	81,000 (c)
City of Long Beach	1960	2 Stone Groins		100%	474,340 (c)
City of Long Beach	1945-46	3 Stone Groins		100%	276,866 (c)
City of Long Beach	1946-1947	2 Stone Groins		100%	208,727 (c)
Jones Inlet (Fed. Coop.)	1953-59	Stone Jetty			
		Hydraulic Fill of 334,397 cu. yds.		100%	3,645,049 (c)
Pt. Lookout	1952-53	3 Stone Jetties		100%	750,000 (c)
Pt. Lookout	1972	Hydraulic Fill of 130,000 cu. yds.		100%	258,000 (d)

References

(a) North Atlantic Division, 1977
(b) NYSDEC, 1976
(c) NYS Conservation Department, 1968
(d) Gilman, J. NYSDEC. Personal Communication, March 19, 1984

Those structures most vulnerable to storm-induced damages are located along the oceanfront, south of Ocean View Ave. An analysis was conducted to determine the land use and structural value of these structures, to determine the fiscal and socioeconomic impacts of their relocation. For the purposes of the analysis, a line was extended west from Ocean View Ave. to the Long Beach City boundary. (See Fig. 3-5.) The value of all structures south of this line from the western City boundary to New York Ave. and the boardwalk was determined using the Nassau County tax assessment records and applying the current equalization rate. Within this relatively small area, there is a combination of single and two-family houses, and multiple unit apartment buildings with a combined total of 294 dwelling units. In addition, there are hotels with 115 units, two day camps, and one restaurant/refreshment stand. The assessed structural value of all buildings within this area is $6,655,947. Including the assessed land value of $2,482,195, the total assessed value of land and structures in this area equals $9,138,142. The magnitude of this figure illustrates the very high structural value at risk in this area.

- Should the West Long Beach area be subject to extensive damage, there is an opportunity for redevelopment that would mitigate future damages. Development constraints include the following elements:
  - Prohibit redevelopment along the oceanfront and construct a dune to create a degree of storm protection for all.
  - Cluster development and redevelopment away from the immediate oceanfront.
  - Develop new street patterns to accommodate the clustering or construction of multi-story buildings and remove the existing north/south street orientation, which serves as a ready conduit for flood waters.

Zoning requirements for the West Long Beach area were last modified in 1980. Current standards permit only single family houses along the oceanfront, all of which must be constructed on piles and elevated to the base flood height. The existing multiple story apartment buildings along the oceanfront are now classified as non-conforming uses, which will not be permitted to rebuild in the event of damage equal to or exceeding 50% of structural value. The inland portion of the study area remains zoned for single family houses, with a limited commercial strip along West Beech St.

Post-storm redevelopment should focus on prohibiting the rebuilding of the line of oceanfront structures, and instead establishing a protective dune to provide a measure of storm protection for all. Residents of Long Beach have resisted dune construction in the past, preferring an unobstructed ocean view. However, an oceanfront dune would have reduced the effects of flooding experienced in 1938, 1944, 1950, 1960, 1962 and 1984. Redevelopment could then take the form of clustered or multistory construction at less vulnerable inland locations.

3.3 JONES BEACH BARRIER ISLAND: REACH PROBLEMS AND STRATEGIES

The Jones Beach barrier island is located almost entirely within the **V** zone, and is subject to intense wave and flooding impacts in the event of a storm. Except for concrete rubble and wooden groins at Oak Beach (Fig. 3-11), the shoreline is void of sand entrapment devices, such as groins or jetties; however, the entire length of the dune system has been filled and leveled for Ocean Parkway.

There are scattered bits of freshwater wetlands inland. Tidal wetlands dominate the bay side of the barrier island and the adjacent bay islands. The beach is artificially nourished through the by-pass of sand dredged from Fire Island Inlet. The many wetland islands directly north of the barrier island are undeveloped, save for small sections of Oak and Captree Islands. Extensive dredging along the bay side of the barrier has occurred primarily to create the State boat channel and to obtain fill for the construction of Ocean Parkway.

The remainder of the reach, except for several commercial establishments and the primarily seasonal, low-to-medium density residential development at West Gilgo Beach, Gilgo Beach, Oak Beach, Oak Island and Captree Island, is open space and recreational. This entire reach is publicly owned. The land containing the commercial and residential development is owned by the Town of Babylon, but is leased to individuals and leaseholder associations.

Figure 3-11
Oak Beach–
Concrete rubble for shore protection near Fire Island Inlet

The recreational use of this reach is particularly intensive, with Jones Beach attracting between 8-10 million visitors per year.* There is a substantial public infrastructure investment, and the shoreline is maintained with a beach nourishment program. Major recreational facilities include Jones Beach State Park, Captree State Park, Gilgo State Park, and Town of Babylon and Town of Oyster Bay beaches. The public benefits of these recreation facilities justifies their continued protection.

All of the commercial and residential development within this reach, with the exception of that located on the bay islands, is in the **V** zone. There are still a number of vacant town owned lots scattered within the developed communities. The continuance of private residency on the Jones Beach barrier island and bay islands conflicts with the goals of this study.

Illegal parking along the Ocean Parkway and illegal access through the dunes have been persistent problems along the Jones Beach reach. There have also been problems with improper use of off-road vehicles. The strategies recommended for Jones Beach barrier island are presented in Table 3-5.

* Personal communication, Long Island State Park and Recreation Commission, 1984.

3.3.1 Gilgo/Oak Beach Detailed Study Area:**

3.3.1.1 General Description and Problem Statement. The Jones Beach barrier island detailed study area (Fig. 3-13) encompasses the five residentially developed communities at West Gilgo Beach, Gilgo Beach, Oak Beach, Oak Island and Captree Island. Many of the residences in these communities are used year-round (except on Oak Island) and are privately owned, but are located on land leased from the Town of Babylon. In three of these areas (West Gilgo Beach, Oak Island and a portion of Oak Beach) homeowners associations lease all or large segments of the communities from the Town of Babylon. The homeowners associations, in turn, have leased parcels to individuals who have subsequently constructed single family homes. (See Figs. 3-14 to 3-18.)

** Includes communities of West Gilgo Beach, Gilgo Beach, Oak Beach, Oak Island and Captree Island.

TABLE 3-5

Jones Beach Reach Strategies

EROSION AND FLOOD CONTROL MEASURES

- Encourage natural sand transport patterns, but artificially maintain the shoreline as required.
- Maintain inlets at current locations and configurations. Close new inlets if they develop. Do not allow commerial or residential structures to be rebuilt after a breach is repaired.
- Protect and maintain dunes. Construct pedestrian crossover points along Ocean Parkway, as required, to allow for safe pedestrian access to beach and to protect dunes. (See Fig. 3-12)

THE NFIP AND FEDERAL POLICIES

- Target federal investments to recreational facilities on this barrier island.

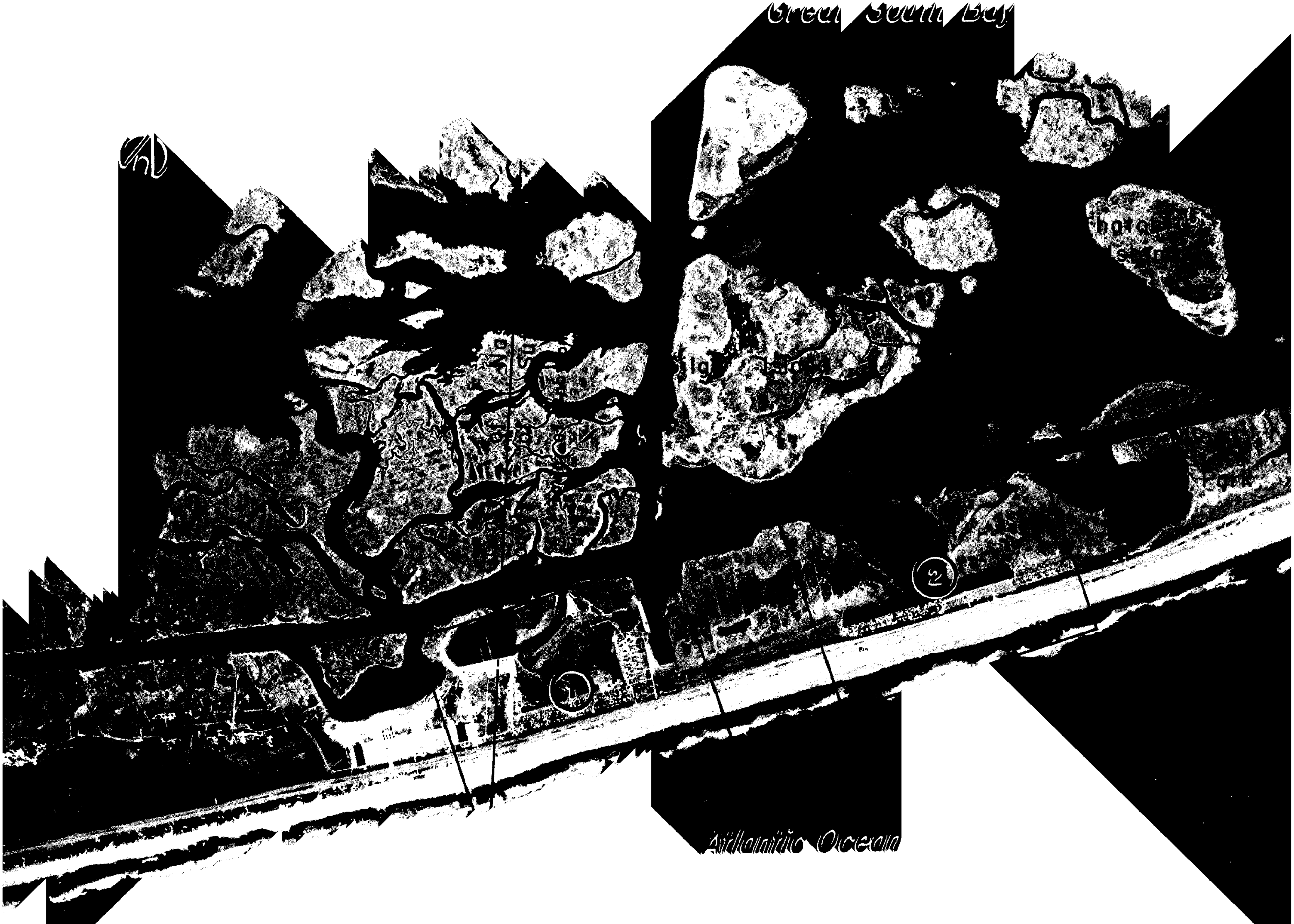
LAND USE AND DEVELOPMENT PATTERNS

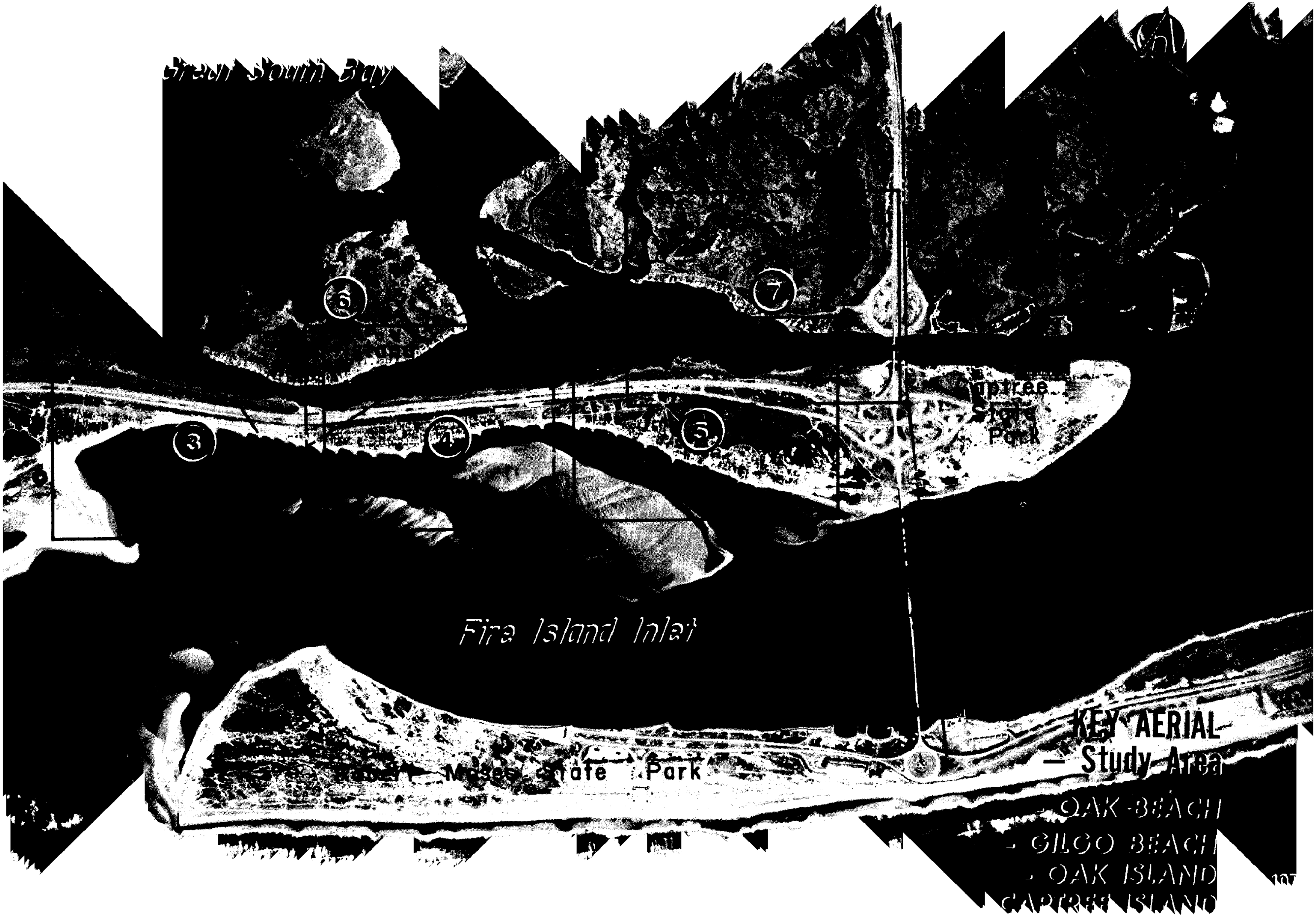
- Retain and expand recreational uses as the most appropriate land use in this reach.
- Prohibit the rebuilding of structures if they suffer damage from storm-related flooding and/or erosion equal to or exceeding 50% of structural value.
- Provide for the gradual phase-out of leases to homeowners on publicly owned land.

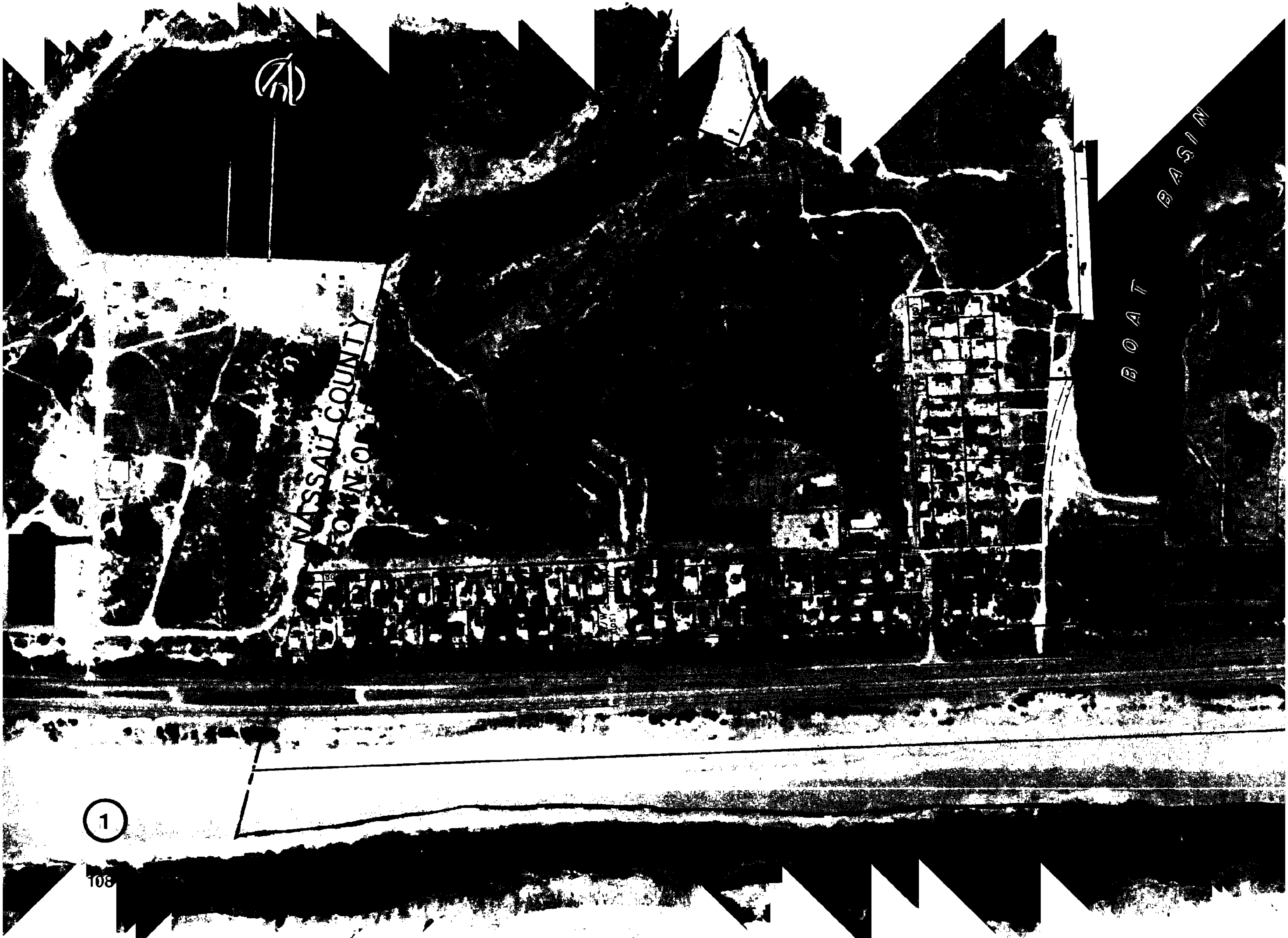
ENVIRONMENTAL REGULATIONS

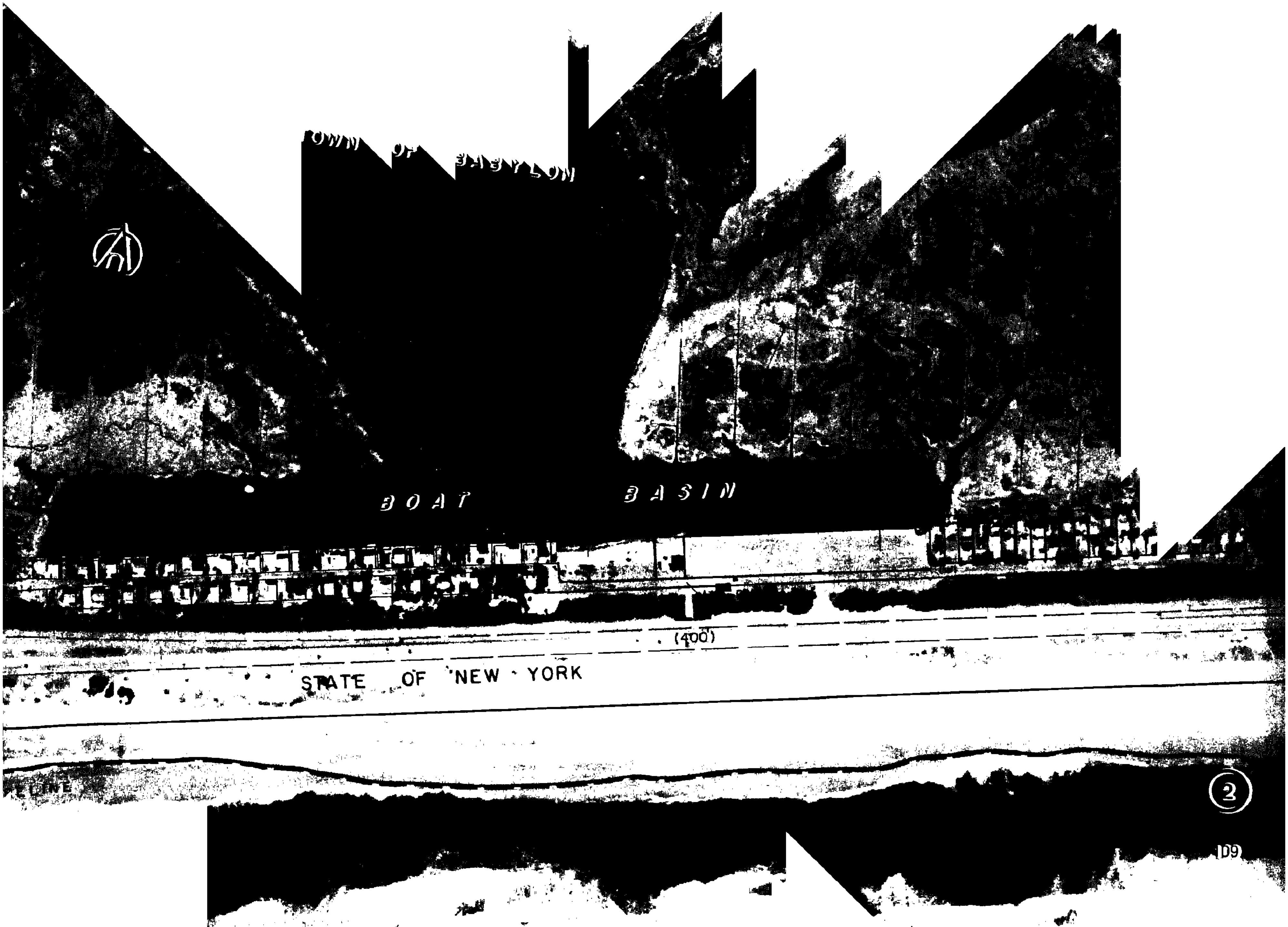
- Improve the control of off-road vehicle traffic and illegal access sites.
- Enforce the prohibition on illegal parking along Ocean Parkway.

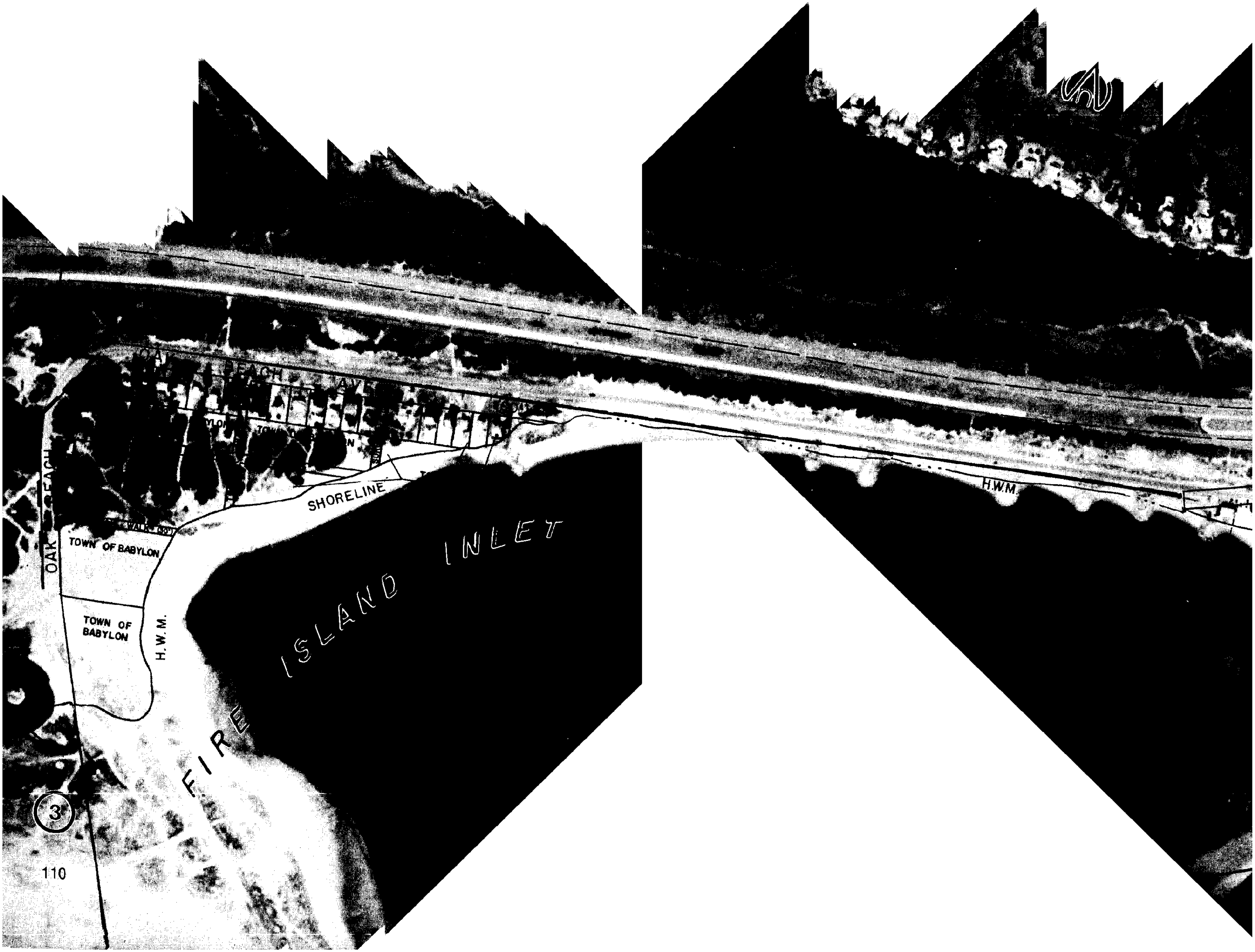
Figure 3-12
Lido Beach–
An example of dune cross-over walk

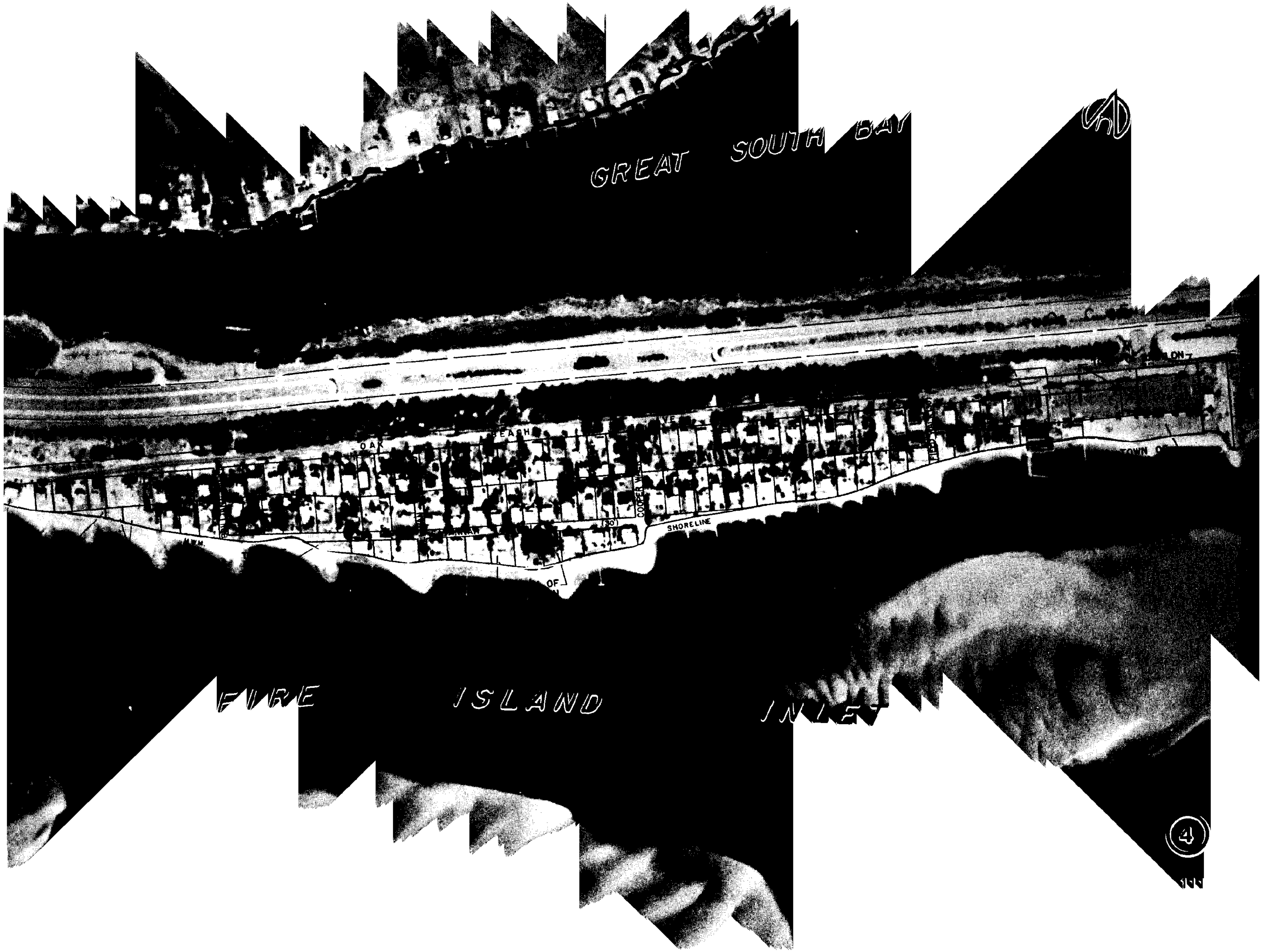

1
2
Atlantic Ocean


Great South Bay
6
7
3
4
5
Captree
State
Park
Fire Island Inlet
Robert Moses State Park
KEY AERIAL
— Study Area
OAK BEACH
GILGO BEACH
OAK ISLAND
CAPTREE ISLAND

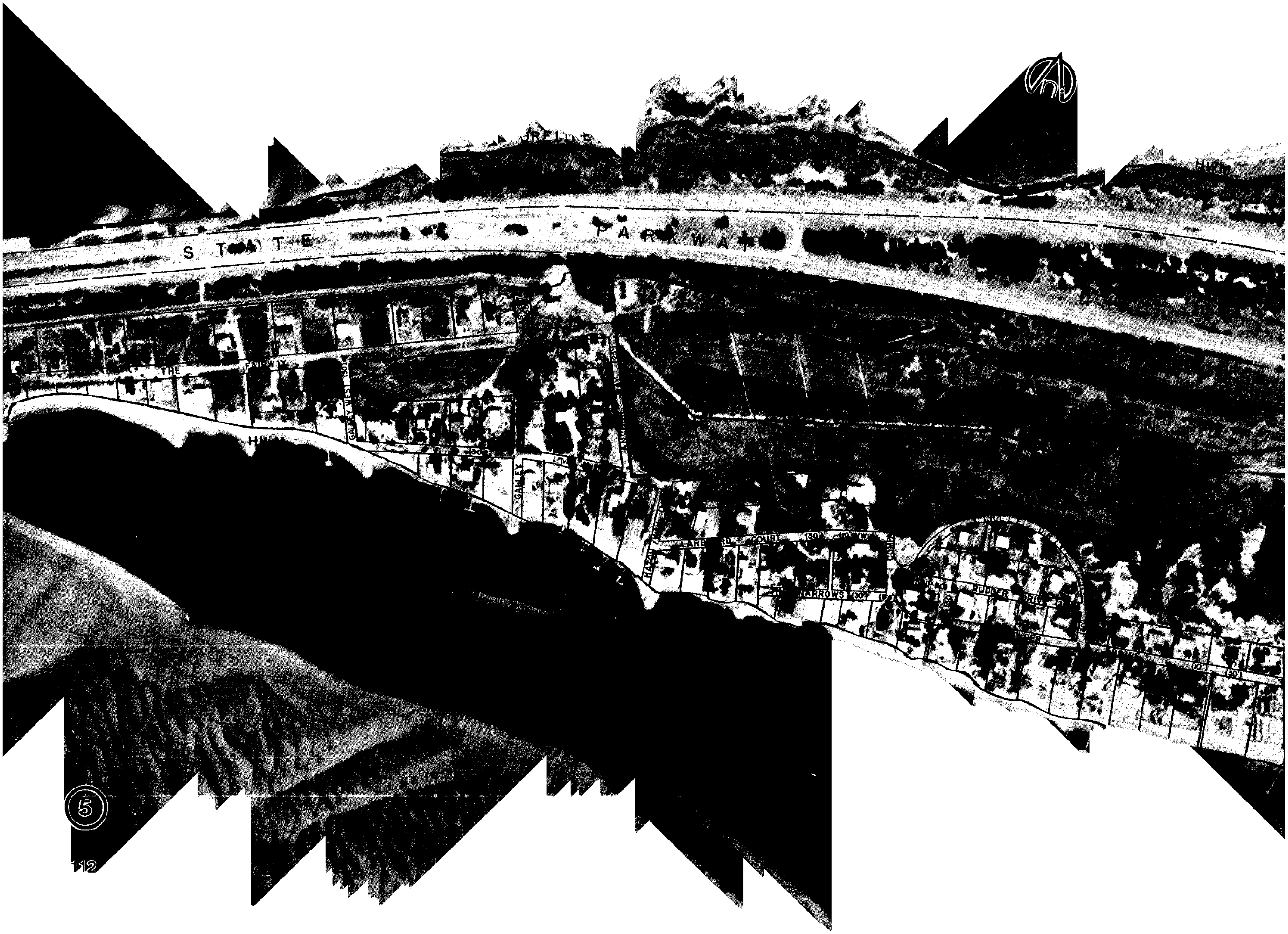

BOAT BASIN
NASSAU COUNTY
1

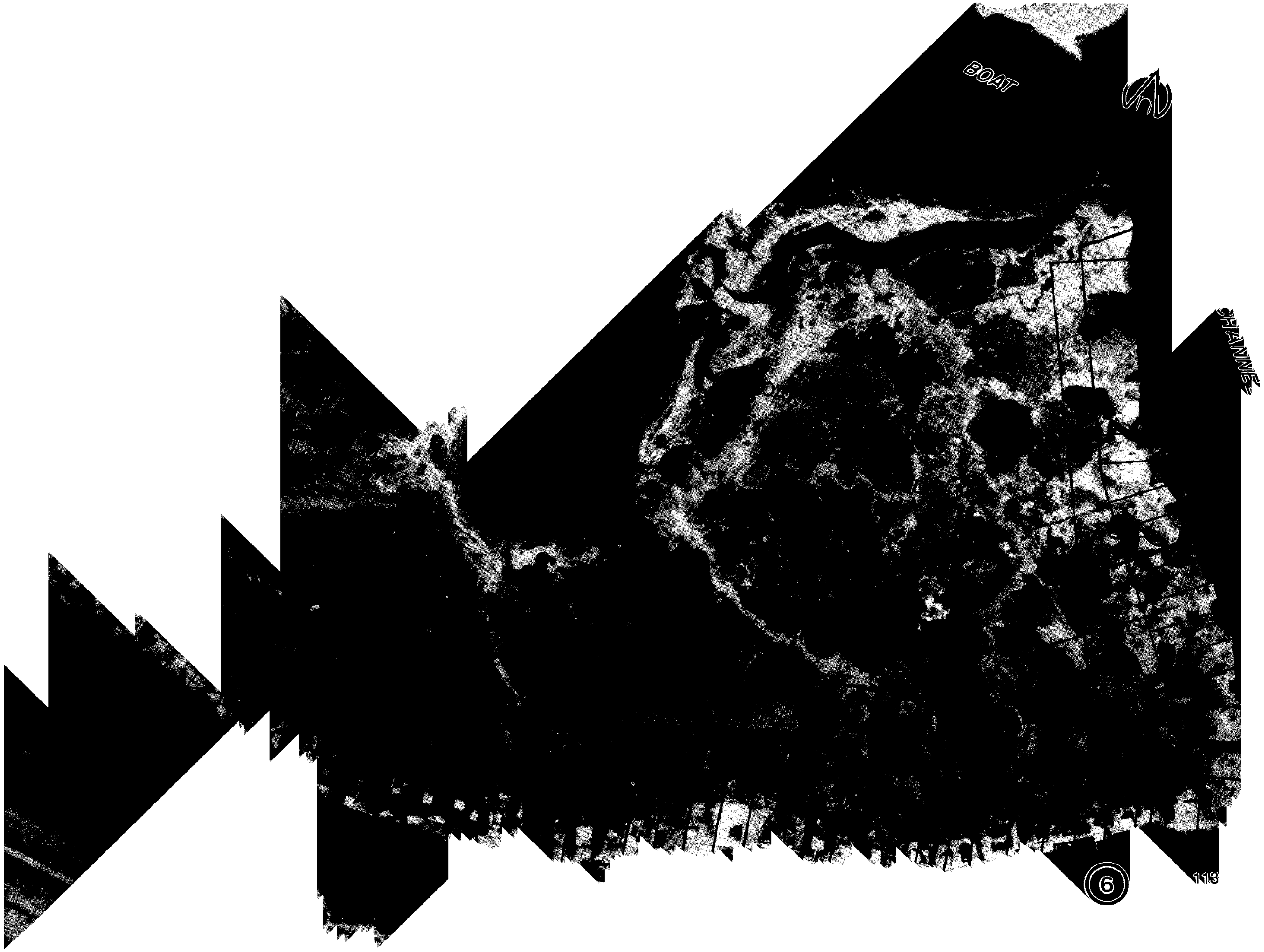

OWN OF BABYLON
BOAT BASIN
(400)
STATE OF NEW YORK
LINE
2


OAK BEACH AVE
OAK BEACH
SHORELINE
TOWN OF BABYLON
TOWN OF BABYLON
H.W.M.
FIRE ISLAND INLET
H.W.M.
3



GREAT SOUTH BAY
OAK
BEACH
COOPER
SHORELINE
FIRE ISLAND INLET
4


S T A T E
P A R K W A
THE
GALLEY WEST
GALLEY
RUDDER DRIVE
5



BOAT
CHANNEL
6
113


OF BA
(STATE OF
7

Figure 3-14
W. Gilgo Beach–
Typical housing

NOTE:
Both figures depict residential development having habitable floor space below base flood elevation

Figure 3-15
Gilgo Beach–
Typical housing

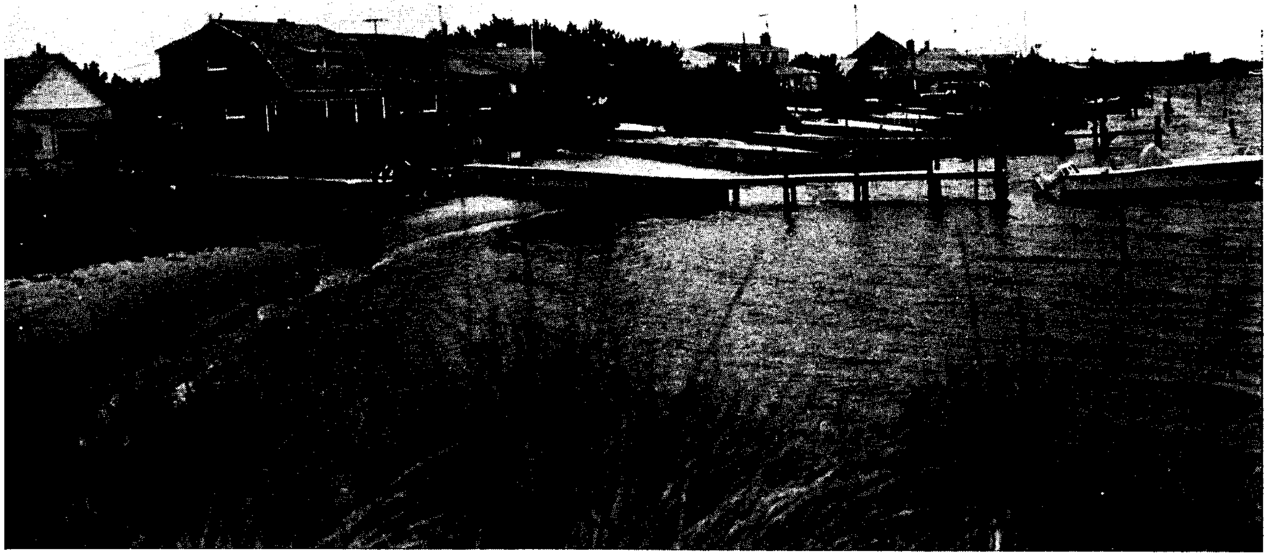


Figure 3-16
*Oak Beach–
Shoreline housing*

*NOTE:
Both figures depict extensive residential development in the 100 yr. floodplain*

Figure 3-17
*Captree Island–
Shoreline housing*

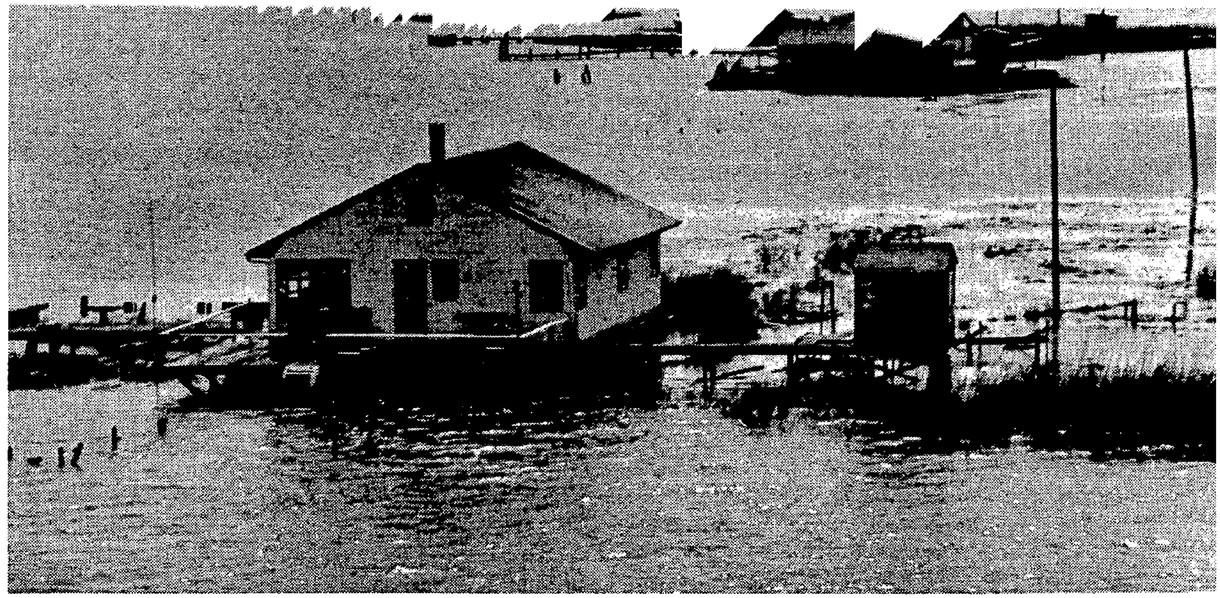


Figure 3-18
Oak Island–
Flood waters surrounding houses

(photo-courtesy Newsday)

It is important to note that all of the development on the barrier island is located entirely in the **V** zone (West Gilgo Beach, Gilgo Beach and Oak Beach) and that erosion is threatening the Oak Beach area homes. The Oak Island and Captree Island communities are located in the **A** zone. Total value at risk in these five areas is $31.3 million in the **V** zone and $11.2 million in the **A** zone (based on 1980 Census data). It should also be noted that the Town has developed four active recreation facilities within or adjacent to these areas. These facilities are at Overlook Beach, Cedar Beach, Gilgo Beach and Oak Beach.

The residentially developed areas on the Jones Beach barrier island were selected because of the severe flood damage potential. The Town of Babylon has the opportunity to eventually redevelop leased properties on the barrier and bay islands to provide additional recreational facilities and open space for all town residents to enjoy.

3.3.1.2 Gilgo/Oak Beach Strategies

- The Town should not grant new leases or permit additional construction on leased property.
- The Town should never sell the publicly owned land to leaseholders or private interests.
- The Town should phase out leases on town owned property over the long-term. The Town should investigate the option of extending the leases on an individual basis to allow present leaseholders a chance to amortize their structural investment over a 30-year period, in exchange for leaseholder agreement that structures will not be rebuilt after sustaining damage from storm-related flooding and/or erosion equal to or exceeding 50% of structural value. The 30-year amortization period would begin at the time a structure was built or purchased by the current leaseholder. Leases would be extended beyond their current termination dates to the extent necessary to provide for the 30-year period. In those cases where structures will have been owned by the same party for a period greater than 30 years when the existing leases expire, lease extensions would not be warranted.
- After phase-out of leases, the Town should provide facilities for additional public recreational use and implement programs for natural resource protection.

In June 1984, the Town of Babylon adopted a nine month moratorium on the issuance of building permits on the barrier and bay islands. The number of vacant lots within the communities that can be considered developable building lots is shown in Table 3-6. Considering the presence of tidal wetlands, access and size of subdivided lot, it was determined that there are 82 vacant developable lots that are either leased to homeowner associations or held by the Town.

Table 3-6 also shows that only 1/3 of the mailing addresses of the 420 leaseholders are located on the barrier and bay islands. The Town of Babylon does not require town residency as a condition to obtain a lease for property on the barrier or bay islands. Over 50% of the mailing addresses of the 420 leaseholders are not within the Town of Babylon.

TABLE 3-6

Structures and Vacant Lots on Barrier Island and Bay Islands in Town of Babylon

Area or Property Leaseholders Assoc.	Mailing Address* of Leaseholders: Babylon Barrier Beach and Bay Islands	Town of Babylon Mainland	Other	No. of Structures**	Vacant Lots***: Leased to Individuals or Assoc.	Town Held	Total Vacant Lots
West Gilgo Beach (West Gilgo Beach Assoc.)	22	1	57	80	0	26	26
Gilgo Beach–western section	5	1	30	36	0	17	17
Gilgo Beach–eastern section	2	9	11	22	0	0	0
Oak Island (Great South Bay Isles Assoc. Inc.)	3	21	30	54	7	0	7
Captree Island	16	4	12	32	1	0	1
Oak Beach–western section	5	7	11	23	0	0	0
Oak Beach–middle section	42	9	48	99	1	4	5
Oak Beach–eastern section (Oak Island Beach Assoc.)	42	9	23	74	26	0	26
TOTAL	137	61	222	420	35	47	82

*Mailing address on record with Receiver of Taxes, Town of Babylon, 1983-1984, for individuals leasing town-owned property on the barrier island or bay islands.
**Includes residential and commercial.
***includes only those lots where a residential structure could be accommodated considering tidal wetlands, access, and size of subdivided lot.

The 1980 Census has recorded that 246 of the 418 homes (59%) on the barrier and bay islands in the Town of Babylon are used on a seasonal basis. The 1960 Census data list 351 of the 402 homes (87%) on the barrier and bay islands in the Town of Babylon as seasonal. As shown by the Census data, conversion of seasonal dwellings to year-round homes on the town owned land has been on the rise. (See Fig. 3-19.) Considering the bridge and road access to the mainland and the year-round utility service (except for Oak Island), one can expect the trend for conversion to year-round residency to continue on Jones Beach and Captree Islands.

Over the last decade the number of school age children transported from the barrier and bay islands to the Village of Babylon schools on the mainland has also increased considerably and now totals 43 pupils. An additional six students are transported to private schools. The current student enrollment in the Village of Babylon school district is 1803, and the 1983-84 property tax levied on property in the school district is $6,959,102. The amount of property tax supporting each student in the district equals $3860. Thus, the cost of public education in terms of property tax dollars for the 43 students from the barrier and bay islands during the 1983-84 school year is $165,980., not including extraordinary transportation costs. The school district property taxes for 1983-84 that were paid by leaseholders on the barrier and bay islands totaled $445,921. Although there now exists a property tax situation advantageous to the school district, there is no certainty that this situation will continue to exist considering the rise in year-round residency and school enrollment on the barrier and bay islands.

A detailed listing of all current property taxes and lease fees collected from leaseholders on the barrier and bay islands is contained in Tables 3-7 and 3-8. Leaseholders paid a total of $719,389 in property taxes for 1983-84 and $121,950 in lease fees for 1984. Table 3-9 illustrates the proportion of property tax raised from leaseholders for various taxing entities. The property tax contribution of the leaseholders ranges from 6.4% of the total Village of Babylon school district property tax to less than 1% of the total Town of Babylon property tax, Suffolk County property tax within Babylon Town, and Suffolk County Police property tax within Babylon Town.

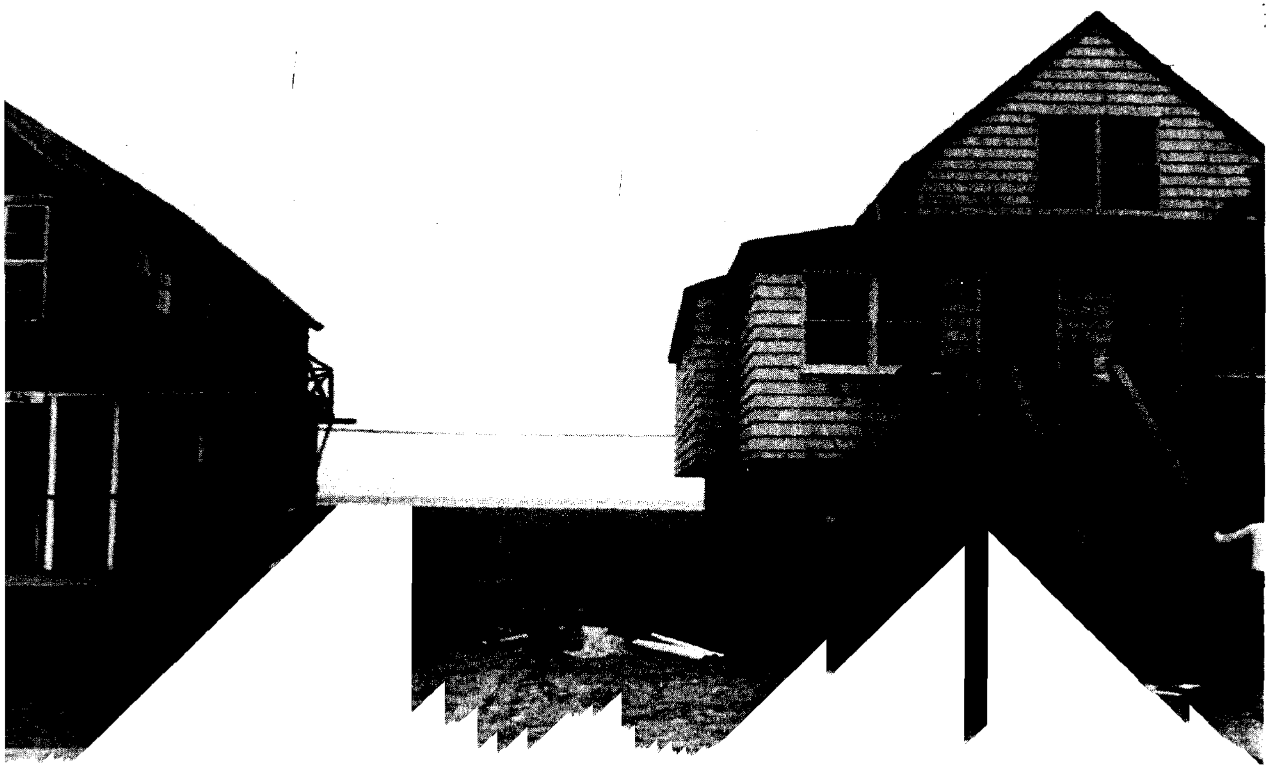


Figure 3-19
Gilgo Beach–
Expansion of habitable floor space below flood elevation in the **V** *Zone*

TABLE 3-7

Property Taxes and Lease Fees for Lots on Barrier Island and Bay Islands in Town of Babylon

Area or Property Leaseholders Assoc.	Property Taxes for 1983-1984						Lease Fees for 1984			
	Town	Special Dist.	School	County	County Police	Total	Fee/Structure	# of Leases	Lease Revenue	Total Taxes and Fees
West Gilgo Beach (West Gilgo Beach Assoc.)	$16,993	$3,786	$81,322	$9,026	$19,832	$130,960	$225	80	$18,000	$148,960
Gilgo Beach–western section	10,268	3,201	50,875	5,454	11,984	81,783	525	36	18,900	100,683
Gilgo Beach–eastern section	2,910	861	13,631	1,546	3,396	22,345	325	22	7,150	29,495
Oak Island (Great South Bay Isles Assoc., Inc.)	5,780	467	27,652	3,070	6,745	43,714	225	54	12,150	55,864
Captree Island	6,394	2,056	35,260	3,396	7,462	54,569	200	32	6,400	60,969
Oak Beach–western section	5,187	1,550	24,539	2,755	6,053	40,084	350	23	8,050	48,134
Oak Beach–middle section	21,502	6,300	98,584	11,421	25,094	162,901	350	99	34,650	197,551
Oak Beach–eastern section (Oak Island Beach Assoc.)	22,905	7,174	114,056	12,167	26,732	183,034	225	74	16,650	199,684
TOTAL	$91,939	$25,395	$445,921	$48,835	$107,300	$719,389		420	$121,950	$841,339

TABLE 3-8

Average Property Tax per Structure on Barrier Island and Bay Islands in Town of Babylon

Area or Property Leaseholders Assoc.	Property Taxes for 1983-1984					
	Town	Special Dist.	School	County	County Police	Total
West Gilgo Beach (West Gilgo Beach Assoc.)	$212	$47	$1,017	$113	$248	$1,637
Gilgo Beach–western section	285	89	1,413	152	333	2,272
Gilgo Beach–eastern section	132	39	620	70	154	1,016
Oak Island (Great South Bay Isles Assoc., Inc.)	107	9	512	57	125	810
Captree Island	200	64	1,102	106	233	1,705
Oak Beach–western section	226	67	1,067	120	263	1,743
Oak Beach–middle section	217	64	996	115	253	1,650
Oak Beach–eastern section (Oak Island Beach Assoc.)	310	97	1,542	164	361	2,473
Average of all above areas	219	60	1,062	116	255	1,713

TABLE 3-9

1983-1984 Property Tax Contributions of Leaseholders on Barrier Island and Bay Islands in Town of Babylon

Area or Property Leaseholders Assoc.	Town Property Tax	% of Total Town Property Tax	School District Property Tax	% of Total School District Property Tax	County Property Tax	% of Total County Property Tax in Babylon Town	County Police Property Tax	% of Total County Police Property Tax in Babylon Town
West Gilgo Beach (West Gilgo Beach Assoc.)	$16,993	.10	$81,322	1.2	$9,026	.09	$19,832	.09
Gilgo Beach–western section	10,268	.06	50,875	0.7	5,454	.05	11,984	.05
Gilgo Beach–eastern section	2,910	.02	13,631	0.2	1,546	.01	3,396	.02
Oak Island (Great South Bay Isles Assoc., Inc.)	5,780	.03	27,652	0.4	3,070	.03	6,745	.03
Captree Island	6,394	.04	35,260	0.5	3,396	.03	7,462	.03
Oak Beach–western section	5,187	.03	24,539	0.4	2,755	.03	6,053	.03
Oak Beach–middle section	21,502	.12	98,584	1.4	11,421	.11	25,094	.11
Oak Beach–eastern section (Oak Island Beach Assoc.)	22,905	.13	114,056	1.6	12,167	.11	26,732	.12
TOTAL	$91,939	.52 (of $17,812,859)	$445,921	6.4 (of $6,959,102)	$48,835	.46 (of $10,629,241)	$107,300	.49 (of $21,914,100)

Over the years, the Town has made leased property available for development and, by means of the lease agreements, has required leaseholders to construct dwellings on what is now classified by FEMA as a **V** zone. Current leases require that the leaseholder construct a house, cottage or building with a value of at least $10,000 on said premises within one year of the date of the lease agreement. A schedule of rents associated with the leases on lots within the various communities on the barrier and bay islands is shown in Table 3-10. The Town has leased property here since the late 19th century. In the mid-1970's, the Town renewed the leases on barrier and bay island lots for a period of 25 years. Thus, the current leases do not expire until the turn of the century.

The long lease term, coupled with the year-round vehicular access, close proximity to New York City, and waterfront and park-like setting have contributed greatly to the market value of the structures on the barrier and bay islands. The routine renewal of leases by the Town in the past and the current long-term lease extensions may have given some leaseholders a false sense of real property ownership and financial security. Although the 1980 Census data do not show the leaseholders to be in a low income bracket (median yearly family income for the subject area is $27,188 compared to the Suffolk County average of $24,195), the Town should be prepared to provide relocation assistance to those low income, year-round residents now living on the barrier and bay islands once their leases terminate.

TABLE 3-10

Schedule of Rents for Lots Leased by

Town of Babylon on Barrier and Bay Islands

Area or Property Leaseholders Assoc.	**Time Period**	**Yearly Rental Developed Lot**
West Gilgo Beach		
(West Gilgo Beach Assoc.)	1/1/75 - 12/31/83	$200
	1/1/84 - 12/31/88	$225
	1/1/89 - 12/31/93	$250
	1/1/94 - 12/31/99	$275
Map of Gilgo Beach West	1/1/77 - 12/31/77	$450
	1/1/78 - 12/31/82	$500
	1/1/83 - 12/31/88	$525
	1/1/89 - 12/31/93	$550
	1/1/94 - 12/31/99	$575
Map of Gilgo Beach	1/1/77 - 12/31/81	$300
	1/1/82 - 12/31/86	$325
	1/1/87 - 12/31/91	$350
	1/1/92 - 12/31/96	$375
	1/1/97 - 12/31/01	$400
Oak Island*		
(Great South Bay Isles Assoc., Inc.)	1/1/84 - 12/1/01	$225
Captree Island	1/1/75 - 12/31/75	$150
	1/1/76 - 12/31/79	$175
	1/1/80 - 12/31/84	$200
	1/1/85 - 12/31/89	$225
	1/1/90 - 12/31/94	$250
	1/1/95 - 12/31/99	$275
Map of Oak Beach	1/1/77 - 12/31/81	$300
	1/1/82 - 12/31/86	$350
	1/1/87 - 12/31/91	$375
	1/1/92 - 12/31/96	$400
	1/1/97 - 12/31/01	$425

TABLE 3-10 (cont'd.)

Oak Island Beach Assoc.	8/7/73 - 8/6/78	$175
	8/7/78 - 8/6/83	$200
	8/7/83 - 8/6/88	$225
	8/7/88 - 8/6/93	$250
	8/7/93 - 8/6/98	$275

*Lease extension for seasonal residence purpose only.

The Town of Babylon has beach and parking facilities on the barrier island at Gilgo Beach, Cedar Beach, Overlook Beach and Oak Beach. Parking lots at these facilities can accommodate approximately 2000 cars and are utilized to capacity during the summer weekends. Virtually all of the mainland shoreline in the Town of Babylon is fully developed at the greatest population density of any town in Suffolk County, and thus offers little potential for active recreational development. The town owned barrier beach holdings offer the greatest potential for expansion and creation of much needed recreation space within the Town that would be available to all town residents. Recreation and open space, rather than residential development on the barrier and bay islands, will better serve the residents of the Town of Babylon and minimize the potential loss of life and property resulting from the occurrence of severe storm events.

- A detailed land use plan for this area should be prepared, showing the accommodation of public access and additional recreational facilities and the reversion of certain currently developed properties to uses compatible with natural resource values.

The Town should initiate preparation of the detatiled land use study for this area during the existing building moratorium. Funding for this study may be available under a Local Waterfront Revitalization Program grant pursuant to the NYS Coastal Management Program.

3.4 FIRE ISLAND: REACH PROBLEMS AND STRATEGIES

Fire Island is a narrow, highly dynamic barrier island subject to severe erosion and dune migration; it has a predominantly natural shoreline, with an extensive but irregular dune system up to 30 ft in elevation. However, in some Fire Island communities, the dunes have been disturbed, and residences have been constructed along the dune line (Figs. 3-20 and 3-21). The bay side of the reach and the bay islands north of the reach are dominated by tidal wetlands.

The large number of houses in the **V** zone results in a large structural value at risk. Severe erosion of the beach and dunes threatens many residences, and the island has suffered severe damages from historical storm events, including inlet formation and overwash.

Flanked by Robert Moses State Park on the western tip of the reach and Smith Point County Park to the east, the middle of the reach consists of 20 private residential summer communities, public beaches and open space, and a large wilderness area owned by the Federal government as part of the Fire Island National Seashore (FINS) and managed by the National Park Service, U.S. Dept. of the Interior. There have been a number of jurisdictional conflicts on Fire Island, stemming from philosophical differences on management techniques between FINS, the Towns of Islip and Brookhaven, the Villages of Saltaire and Ocean Beach, the unincorporated communities on the Island, and individual property owners. FINS and the Dept. of the Interior are in the final stages of approving the four local zoning codes for Brookhaven, Islip, Saltaire and Ocean Beach. This will resolve a major long-standing conflict on the Island. However, the FINS philosophy of minimizing interference with natural shoreline processes will continue to conflict with those interested in stabilizing the shoreline. The two Towns and two Villages on the Island each have different regulations governing the dune district, all of which meet or exceed the the minimum requirements of the Federal government. Only the Town of Islip has a dynamic dune district line, which is based on existing conditions.

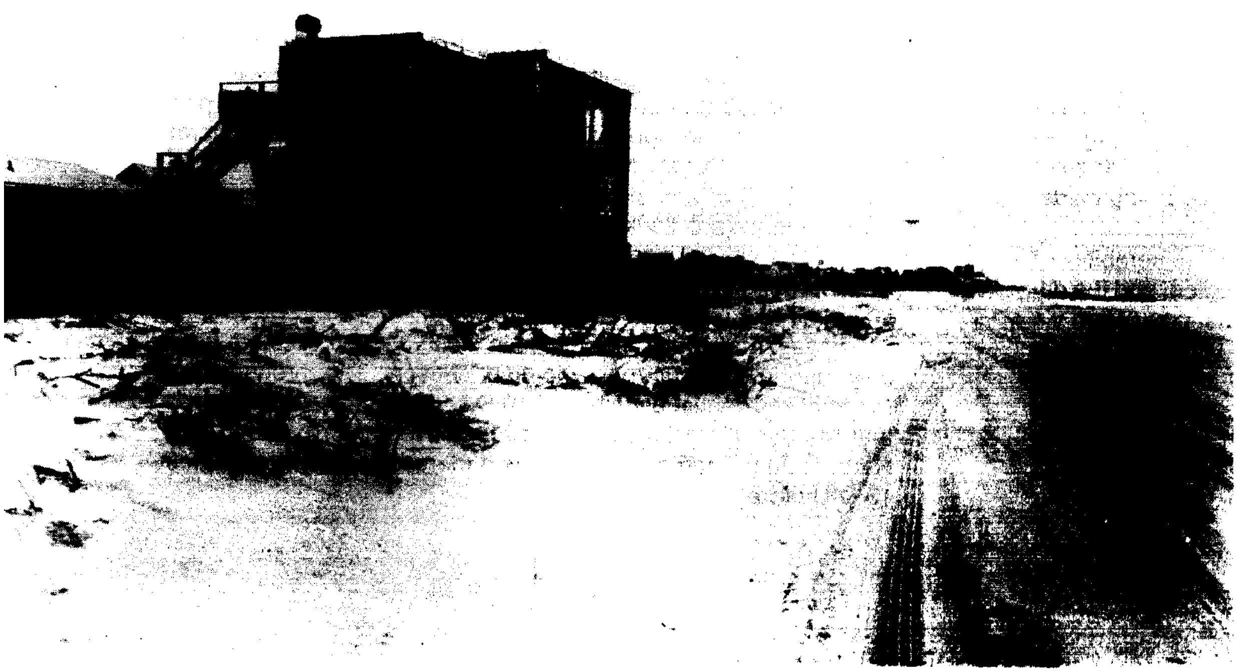


Figure 3-20
Robbins Nest/Corneille Estates
New housing built in vulnerable location

Figure 3-21
Lonelyville–
Eroded oceanfront dunes

A continuing problem on Fire Island is how to control development and post-storm redevelopment in the **V** zone. The communities are almost exclusively seasonal in nature because of the lack of year-round services and paved road access. Judicial decisions in the past with regard to development controls have tended to support property owners and developers, forcing municipalities to either approve development requests or acquire the properties. There have also been problems regarding inadequate zoning and building code enforcement.

Additional problems on Fire Island include the vulnerability of water supply and waste disposal systems to flooding, and the difficulty of swiftly evacuating a very large seasonal population via ferry service. There are bridges at either end of the Island, but no permanent access roads on the Island itself which residents could use to reach the bridges. A seasonal population estimated at over 20,000 would need to be evacuated through the use of ferries to the mainland. The storm hazard mitigation strategies recommended for Fire Island are presented in Table 3-11.

3.4.1 Village of Saltaire to Lonelyville Detailed Study Area

3.4.1.1 General Description and Problem Statement. The incorporated Village of Saltaire and the communities of Fair Harbor, Dunewood and Lonelyville are located on the western portion of Fire Island approximately five miles east of Democrat Point. The detailed study area encompasses approximately 6600 linear feet (lf) of shoreline. Due to long-term shoreline erosion, only the landward flank of the dunes in this area remains (Fig. 3-22); thus, the dunes are low and in some instances, nonexistent. Since the Village of Saltaire's incorporation in 1917, the shoreline has retreated 200 ft northward.

The vast majority of residences in these communities are used only during the summer vacation season. The predominant range of residential density is 5-10 D.U./acre. It should be noted that the density in Saltaire is closer to 5 D.U./acre, and in Fair Harbor, Dunewood and Lonelyville it more closely approximates 10 D.U./acre.

TABLE 3-11

Fire Island Reach Strategies

EROSION AND FLOOD CONTROL MEASURES

- Limit public expenditures for artificial shoreline maintenance east of Robert Moses State Park and west of Smith Point County Park, except where it may be necessary to close or prevent the opening of a new inlet. Should the site of a new inlet include private property, such property should be condemned prior to repair of the breach.
- The implementation of large scale dune building and beach maintenance projects along Fire Island is not recommended. Government agencies (Federal, State, local) should not provide funding for erosion control projects along the waterfront to protect seasonal homes, except for small-scale projects such as snow fencing or vegetation planting.
- The Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project currently being reformulated by the COE is not expected to be completed until 1988. Preliminary estimates for the project, however, indicate that the total cost of the proposed project will be between $300 and $350 million. The Fire Island segment alone is expected to cost approximately $57 million.

  The COE project on Fire Island will include:
  - 154,000 lf of dune for $34.2 million ($222/lf);
  - 38,000 lf of beach nourishment for $6.4 million ($169/lf);
  - up to eight groins (if necessary) for $8.0 million ($1 million/each);
  - limited land acquisition costs of $3.0 million; and
  - engineering, design and supervision costs of approximately $5.4 million.
- Individual owners should bear the brunt of structure loss due to erosion. FINS should not purchase individual storm-damaged structures.
- Any erosion control measures taken by private interests to protect an area of beach should not adversely affect the downdrift transport of sand.
- Institute a uniform, dynamic dune district line for both the Towns of Islip and Brookhaven to protect the dunes and natural shoreline features.

LAND USE AND DEVELOPMENT PATTERNS

- Prohibit development/redevelopment within a uniform, dynamic dune district.
- Severely limit any multi-family or high density development in **V** zones. Such development would be acceptable outside of the **V** zone if total community density is not increased.
- Examine the use of alternative land use strategies such as transfer of development rights.
- Improve enforcement of zonings and building codes on Fire Island.

ENVIRONMENTAL REGULATIONS

- Use critical or environmentally sensitive area designations with associated land use restrictions where warranted to severely limit or ban incompatible activities in fragile areas.
- Locate new public water supply wells away from flood hazard areas. Do not rebuild damaged wells in vulnerable locations.

THE NFIP AND FEDERAL POLICIES

- Coordinate management activities between FINS, the towns and villages to develop a consistent management philosophy.

EVACUATION, WARNING AND PUBLIC EDUCATION

- Establish policies related to ferry evacuation practices.
- Increase police powers to limit access to the Island during storm watch and warning periods.

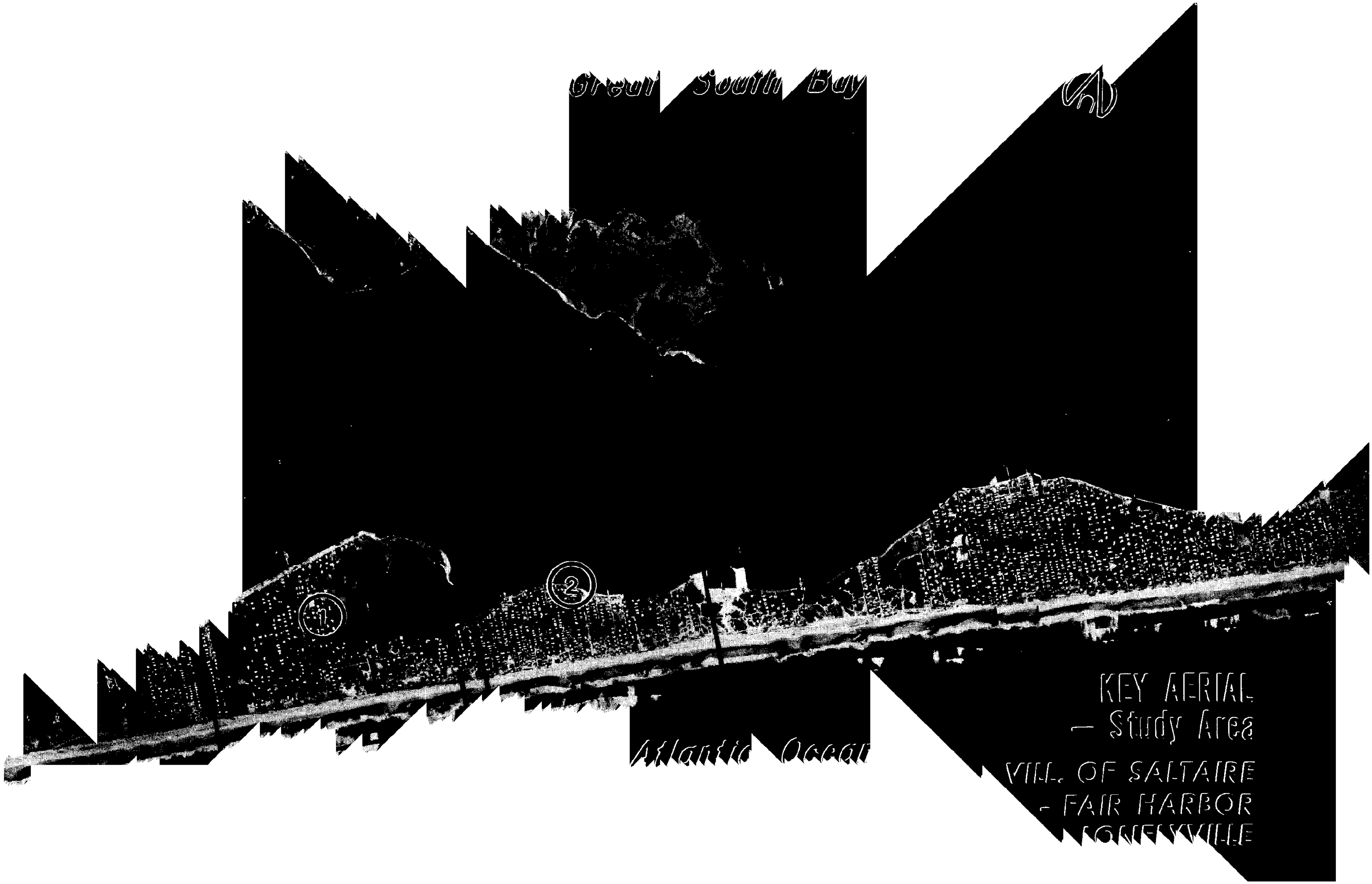
Figure 3-22
Dunewood–
Oceanfront housing with little or no dune remaining

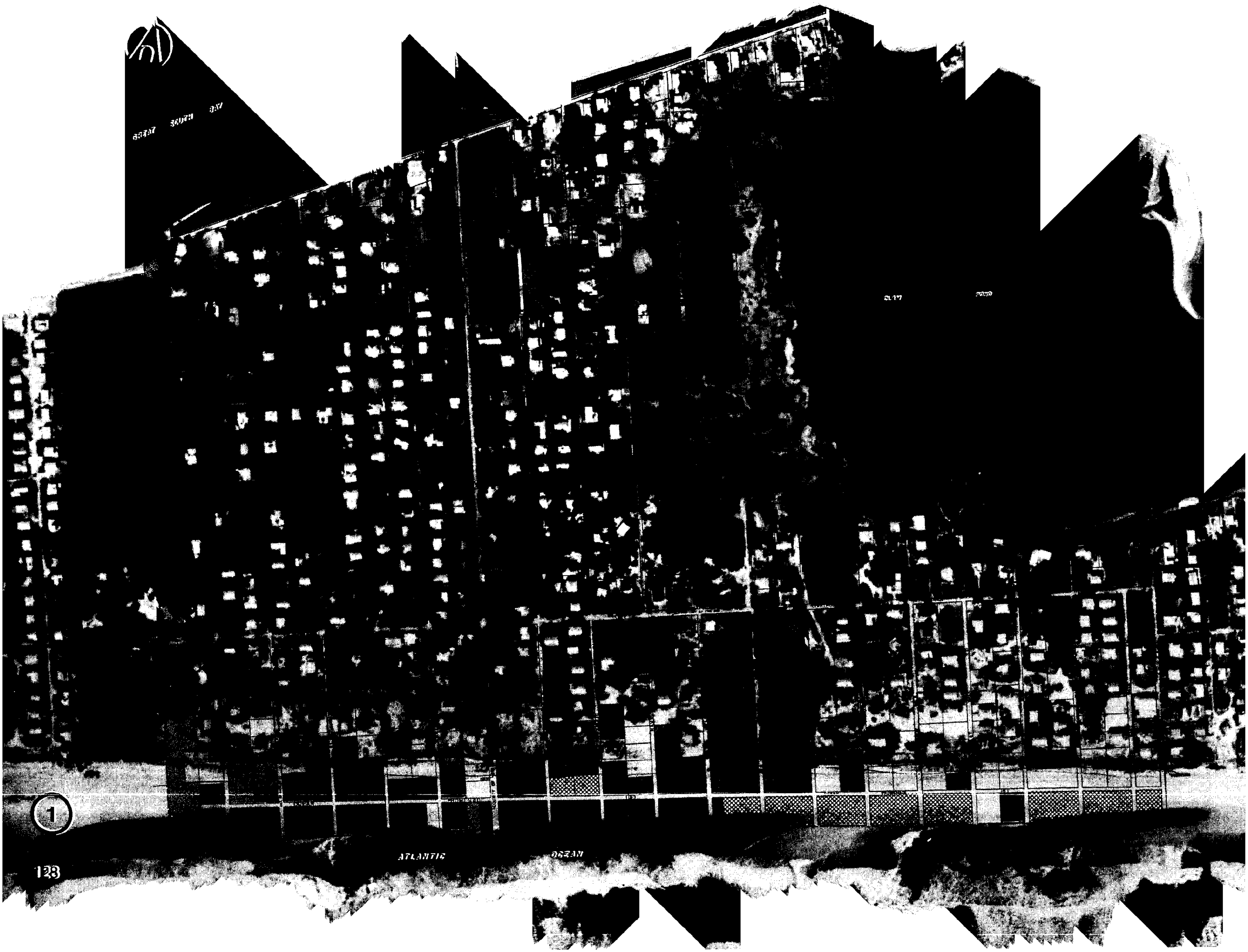
The Village of Saltaire is zoned primarily for single-family residences on lots that approximate 1/4 acre. The communities of Fair Harbor, Dunewood and Lonelyville are zoned for single-family residences on 6000 sq ft lots.

The potential for new residential development is summarized below. Saltaire can accommodate 150 of 267 potential additional structures.

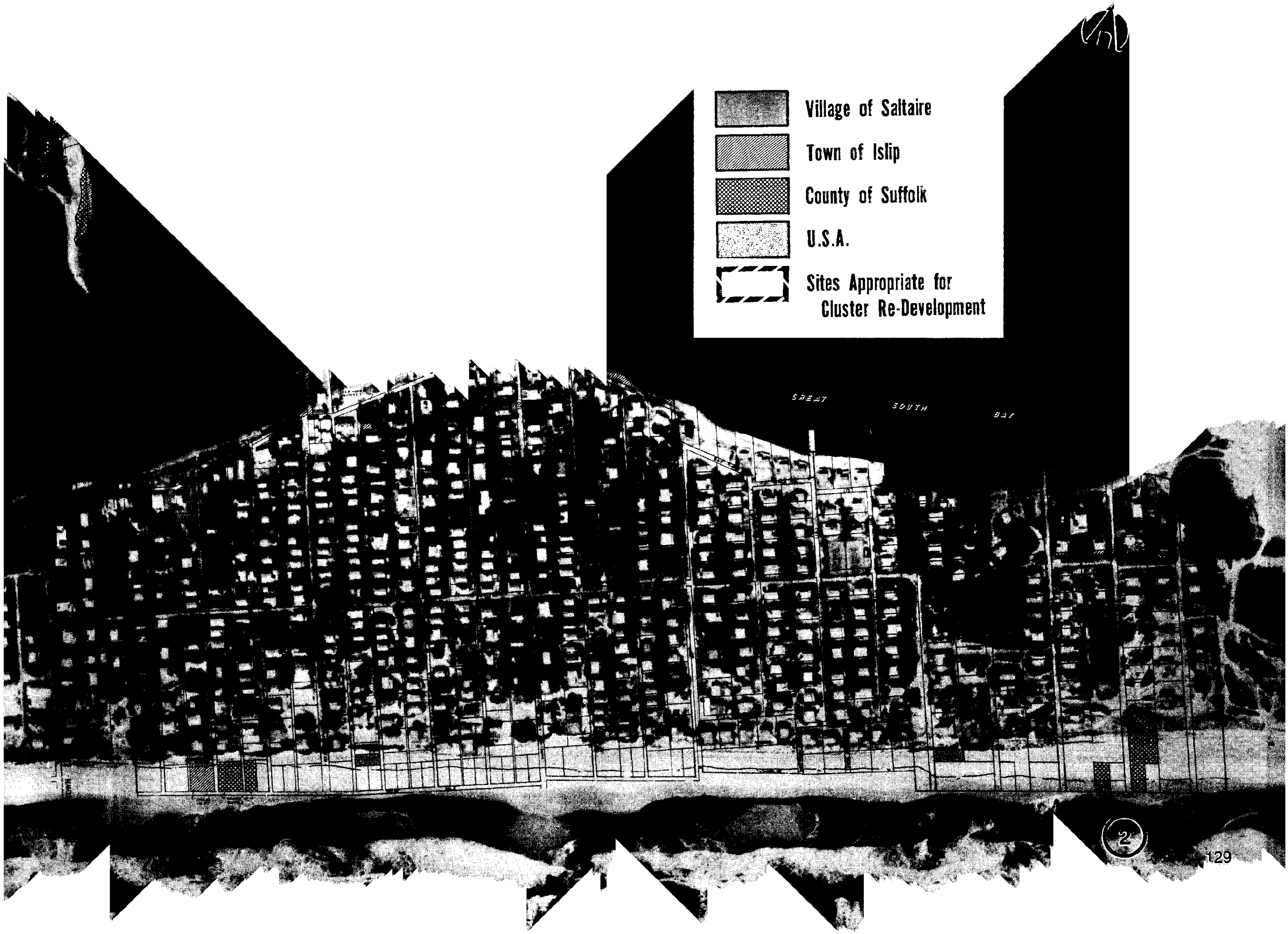
Community	No. of Existing Structures	Potential Add'l. Structures
Saltaire	371	150
Fair Harbor	400	50
Dunewood	98	10
Lonelyville	69	57
Total	938	267

These communities were selected for detailed study principally because they typify flooding problems and patterns of residential development characteristic of the Fire Island reach. Significant flooding last occurred during the northeast storm of March 1962, when seven houses were destroyed from Saltaire to Lonelyville, and an additional 28 were damaged. In the hurricane of 1938, 85 of 158 houses in the Village of Saltaire were totally destroyed. The level of destruction may have been enhanced by the fact that the Fire Island Beach Development Corp., the developers of Saltaire, leveled oceanfront dunes in the early 1900s to entice prospective buyers with an unobstructed view of the sea (Johnson, 1983). Storm-driven water and spring tide conditions in recent years have threatened the Village's water supply well. The structural value of all houses in the 100-year floodplain is approximately $102 million (based on 1980 Census data). Fig. 3-23 shows the Saltaire to Lonelyville detailed study area.


Great South Bay
1
2
Atlantic Ocean
KEY AERIAL
— Study Area
VILL. OF SALTAIRE
- FAIR HARBOR



GREAT SOUTH BAY
ATLANTIC OCEAN
1


Village of Saltaire
Town of Islip
County of Suffolk
U.S.A.
Sites Appropriate for Cluster Re-Development
GREAT SOUTH BAY
2

3.4.1.2 Village of Saltaire to Lonelyville Strategies. Hurricane damage mitigation strategies for the Saltaire to Lonelyville detailed study area must address the possibility of a variety of potential scenarios. The **worst case** scenario involves the direct hit of a major hurricane, such as occurred in 1938. Such a storm would cause enormous damage in the study area, and would necessitate a **wipe the slate clean** type of redevelopment plan. In the absence of a severe hurricane, damage associated with northeast storms will likely be focused on the first several rows of oceanfront houses. Mitigation measures will also address the destruction of individual houses due to long-term erosion. Those houses that are most vulnerable to damage, either from long-term erosion or individual storm events, are located in the NYS Dept. of Environmental Conservation (NYSDEC) Coastal Erosion Hazard Area along the oceanfront.

- Prohibit the rebuilding of structures located in the NYSDEC Coastal Erosion Hazard Area in the event that they suffer erosion/storm damage equal to or exceeding 50% of structural value.

Due to long-term shoreline erosion a number of these houses are now situated directly on, or in some cases seaward of, the primary dune line. (See Figs. 3-24 and 3-25.)

An analysis was conducted to determine the number and value of structures within the Coastal Erosion Hazard Area, as illustrated on the draft coastal erosion hazard maps (NYSDEC, 1984). This line is superimposed on Fig. 3-23. The structural value of all houses within this area was determined using data from the COE Fire Island Inlet to Montauk Point Reformulation Study (URS Company, Inc., 1982) in conjunction with the NYSDEC maps. It was calculated that there are 34 houses in the Village of Saltaire located within the Coastal Erosion Hazard Area with a structural value of $4.4 million. For the remainder of the study area, which includes the communities of Fair Harbor, Dunewood, and Lonelyville, there are 77 houses in the Coastal Erosion Hazard Area with a structural value of $5.2 million.

- As individual houses are damaged or destroyed, the Village of Saltaire should prevent the rebuilding of certain storm-damaged houses along the oceanfront by enforcing its dune protection ordinance.

The Village dune protection ordinance prohibits development within 40 ft of the crest of the primary dune. Any existing homes within this area are classified as non-conforming. A Village ordinance prohibits:

- the rebuilding of non-conforming structures that suffer storm damages equal to or exceeding 50% of structural value
- major (over 50% of value) additions or changes to existing structures
- any new construction within this area.

Should houses along the oceanfront be damaged or new development proposals offered, a survey will be undertaken to determine the 40 ft line and development/redevelopment requests will be denied within this area. This dune protection boundary differs from the proposed NYSDEC Coastal Erosion Hazard Area, which extends 100-200 ft inland from the dune crest.

- Should a significant number of oceanfront houses be damaged or destroyed by a hurricane or northeast storm, the communities should prohibit rebuilding in the same location, and instead encourage the clustering of development at less vulnerable inland locations.

An inventory of all publicly owned land within the Village of Saltaire and the other communities was undertaken using the Suffolk County Real Property Tax Maps, to identify suitable inland parcels for redevelopment. The results of this inventory are shown on Fig. 3-23. There are no parcels currently available for cluster development within the communities of Fair Harbor, Dunewood and Lonelyville. In the Village of Saltaire, however, there appear to be several parcels appropriate for cluster development. The three sites shown on Fig. 3-23 are owned by the Village of Saltaire and are located a sufficient distance inland to be out of the **V** zone.

Provided that the Village owned parcels are not needed for other municipal purposes, the Village should consider selling or swapping these properties to provide alternative sites to those homeowners within the Coastal Erosion Hazard Area that are threatened with the loss of their houses. These parcels could be sold to groups of homeowners, who could establish a cluster development at a density previously specified by the Village. An alternative would be to trade these publicly owned inland sites for the oceanfront sites, provided that the oceanfront homeowner pays the differential in cost between a non-buildable lot and a protected inland site. The Village should also encourage oceanfront homeowners to buy an inland site and donate the oceanfront land to the Village for tax benefits.

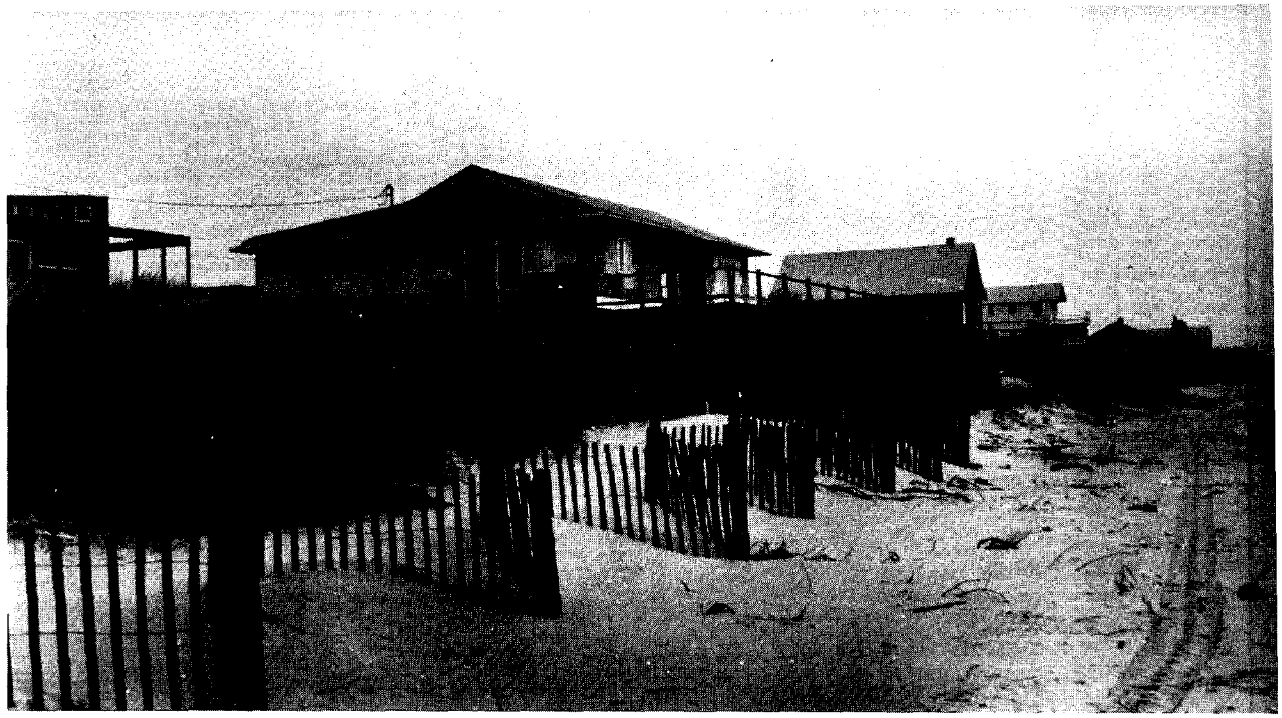


Figure 3-24
Fair Harbor–
Attempt to stem shoreline erosion through use of snow fencing

Figure 3-25
Saltaire–
Rows of snow fencing line beach in attempt to halt shoreline erosion

By selling or swapping these publicly owned parcels to current Village of Saltaire residents, the Village would retain its residents and total tax base, remove housing from the vulnerable and dynamic coastal erosion area, and acquire ownership of the oceanfront strip. The net proceeds from the sale of these parcels could then be used for a program of dune restoration and erosion control, providing a measure of protection to the entire Village.

- Coastal communities, such as the Village of Saltaire, should develop policies and guidelines for post-storm redevelopment now—before the storm—rather than after the event when redevelopment pressures are greatest.

The 1938 hurricane, with flood levels less than that associated with the 100-year storm flood events, destroyed more than half of the houses in the Village of Saltaire. If the equivalent of the 1938 hurricane—or one of an even greater magnitude—were to strike the area today, it would cause damages unparalleled in the history of Long Island. Few people are able to envision the results of a major hurricane, and most community leaders are too busy with day-to-day municipal affairs to make plans for what is perceived as a **low probability** event. Nevertheless, the possibility of a major hurricane impacting the Long Island coast is very real.

Should a major hurricane **wipe the slate clean** at Saltaire, destroying a majority of the existing structures, the first step for the Village would be to initiate an immediate moratorium on all redevelopment. The Village would then have the opportunity to move away from single-family development in vulnerable areas and encourage clustered development at less vulnerable inland locations. This clustered development should be targeted for the area between Harbor Promenade and Lighthouse Promenade. It would probably be necessary to condemn certain private inland properties, as well as use all publicly owned properties, to provide sufficient areas to accommodate this redevelopment. Owners of properties along the oceanfront would be prohibited from rebuilding, using the mechanisms already mentioned, and these property owners would be encouraged to participate in the inland clustered development. A **transfer of development rights** (TDR) proposal could be prepared, whereby those inland property owners whose property is condemned for cluster redevelopment would be issued certain development rights. These development rights could then be sold to builders to construct a number of houses at a greater density on their inland locations. Those Village residents whose houses along the oceanfront were destroyed would have the first opportunity to purchase these new clustered houses, using their compensation from the NFIP. Such a redevelopment plan would result in clustered development between Harbor Promenade and Lighthouse Promenade, and little if any redevelopment south of Lighthouse Promenade.

- In the event of a major storm which destroys large portions of these or other Fire Island communities, an alternative redevelopment proposal would include the use of certain FINS properties as sites for clustered development, in exchange for parcels more susceptible to flooding and erosion damage.

FINS owns, in addition to its wilderness and recreational holdings, a number of undeveloped bay to ocean strips of land between Saltaire and Kismet. These parcels were acquired for open space purposes. FINS personnel have indicated that in the event of a catastrophic storm that destroys large portions of a developed community, the potential exists for using these undeveloped bay to ocean strips for clustered redevelopment, thus providing an opportunity to relocate development in areas of the barrier island that are less vulnerable to flooding and erosion hazards. Ownership of parcels subject to storm damage in the communities would be transferred to FINS in exchange for parcels with a higher residential density in the bay to ocean strips. Instead of the existing grid pattern with single-family houses on individual lots, the clustered redevelopment would accommodate the same number of dwelling units as provided for under current zoning, but at a density three to four times as great in areas less vulnerable to flooding and erosion in the central portions of the Island. Bay and oceanfront parcels, as well as storm-damaged parcels acquired by FINS, would be kept in public open space. The public would gain a net increase in open space on Fire Island, and a protective dune could be created and maintained. Other public entities owning property on Fire Island, together with FINS, should identify publicly owned parcels which could be used for redevelopment purposes in the event of a catastrophic storm. Options for implementing this concept (e.g., creation of a development authority) must be investigated and put in place prior to the occurrence of a major storm. There are several impediments to each of the stated strategies which must first be overcome for implementation to occur. Enforcement of either the Village dune district ordinance, or the NYSDEC Coastal Erosion Hazard Areas Act, which prohibits reconstruction of destroyed structures within certain areas, will prove difficult because homeowners will most likely challenge these laws as confiscatory. Recent judicial decisions* have sided with the homeowners in these instances, forcing the jurisdictions to either grant a variance or pay compensation.

Clustered development within the Village of Saltaire will also be difficult to implement. Current zoning regulations for the Village permit only single-family residential development—there are no provisions for clustered development. Any changes in the zoning regulations would require approval from the Village Board.

The use of Village owned land for clustered development is also unlikely at this time, because the Village has already indicated its desire to sell these properties at public auction. The Village owned properties indicated on Fig. 3-23 as suitable sites for cluster development were acquired on tax lien after the 1938 hurricane. The Village owns these properties jointly with Suffolk County, but the Village has sole responsibility for tax payment to the Town of Islip. Because the tax burden of $60,000/year is almost 10% of the total Village budget, the Village has decided to sell these properties through a public auction at fair market value. These properties constitute a total of 11 building sites (under current zoning regulations) and have been recently appraised at $3 million. Three building sites will be offered for sale this summer, three or four will be offered in 1985, and the remainder will be sold in 1986. Terms of the sale require 30% down payment, and full payment within three years. Suffolk County will receive one-half of the purchase amount, and the Village of Saltaire will retain the other half.

The Village of Saltaire should consider delaying the sale of these properties, and instead prepare a plan to use the properties to relocate structures out of the Coastal Erosion Hazard Area. The Town of Islip should lower the tax assessment on these undeveloped parcels as an incentive for the Village not to sell the properties. The use of certain FINS properties as sites for clustered redevelopment in the event of a major storm should be considered by the Village of Saltaire as well as by the other communities on Fire Island.

* Seidner v. Town of Islip. 453 N.Y.S. 2d 636; 439 N.E. 2d 352; 56 N.Y. 2d 1004.

- The Village of Saltaire should consider the establishment of an erosion control district for small scale or emergency projects, as provided under New York State Village Law: Article 4 - Powers, Etc. of Officers - Section 412; and Article 22 - Local Improvements - Section 2200.

Any village board of trustees may construct drains, culverts, dams and bulkheads, and dredge channels, and regulate water courses, ponds, etc. within or without the village for arresting and preventing damage to property within the village resulting from floods or erosion. Any property acquired or public improvement constructed outside the village requires the approval of the governing body of that city, town or village. The cost of such improvement, including acquisition, can be charged at the expense of the whole village or just the owners of the property benefited pending notice and public hearing.

- The unincorporated areas of Fair Harbor, Dunewood and Lonelyville are also eligible to establish an erosion control district as part of the Town of Islip, under New York State Town Law: Article 12 - District and Special Improvements; and Article 12A - Establishment or Extension of Improvement Districts, Alternative Procedure - Sections 190-209h.

The town board of any town which borders navigable waters may establish or extend in their town a beach erosion control district, public dock district, harbor improvement district or aquatic plant growth district and provide improvements and/or services totally at the expense of the district. This district cannot be established or extended within a city or incorporated village boundary. However, a district or part of a district can be established in an incorporated village if the village consents to such establishment by local law and subject to a petition (Village Home Rule Law - Section 6) or a permissive referendum (Village Law - Article 5A).

3.5 WESTHAMPTON BARRIER ISLAND: REACH PROBLEMS AND STRATEGIES

The most significant problem along this reach is the severe erosion along the oceanfront shoreline of the unincorporated portion of Westhampton Beach west of the last groin, where a large number of houses are in imminent danger of destruction. Many houses have already been destroyed, and others remain in extremely vulnerable locations. There have been frequent breaches and washovers along this section of the reach, leaving the Town of Southampton with large road maintenance expenditures. Beside the acute problems in this area, the entire reach is vulnerable to storm damages, as evidenced by historical storm events and the **V** zone flood designation. (See Figs. 3-26 to 3-28.)

Significant public investments in shoreline engineering and maintenance along this reach have been made in the past, including the construction of a series of 15 stone groins, the beach fill and revetment construction at Cupsogue Beach, and the stabilization of the Moriches and Shinnecock Inlets. Any structural solution to the erosion problem on this reach will involve an even greater commitment of public funds in the future.

The eastern half of the reach is a natural beach and dune shoreline system, with dunes up to 30 ft in height, primarily used for recreational use. There is extensive residential, beach club and motel development in the western half of the reach. Some of the high density residential and commercial structures are nonconforming with respect to the Village of Westhampton Beach zoning and building code ordinances. The vast majority of the population on the reach is currently seasonal, but given the existing bridge and road access, and year-round utility service, the potential for conversion to a year-round community is high. Furthermore, there are continuing development pressures adjacent to the environmentally sensitive wetlands of the reach.

Figure 3-26
Westhampton Beach–
Oceanfront homes rendered inaccessible during the northeast storm of 29 March, 1984

Photo–courtesy Newsday

Figure 3-27
Westhampton Beach–
Oceanfront homes west of the last westerly groin that are extensively vulnerable to storm induced flooding

Figure 3-28
Westhampton Beach–
House damaged by storm

A concern for this reach is that the houses on the barrier island comprise approximately 15% of the Remsenberg/Speonk School District property tax base. The fiscal impacts of removing these houses or losing them as a result of a storm event are examined later in this section. Additional problems along this reach include limited public shorefront access, and the difficulty of evacuating residents west of the Jessup Lane bridge in the event of a breach of Dune Road. Strategies for the Westhampton barrier island are presented in Table 3-12.

3.5.1 Westhampton Beach Detailed Study Area

3.5.1.1 General Description and Problem Statement. The Westhampton Beach detailed study area includes the barrier island extending east from Moriches Inlet to the most westerly groin, including the 220 acre Cupsogue County Park. With the exception of the County Park, the land in the study area is used principally for medium density seasonal residences. There is also a small amount of land used for commercial-recreation purposes. The area is zoned for single-family residences on one

TABLE 3-12

Westhampton Barrier Island Reach Strategies

EROSION AND FLOOD CONTROL MEASURES

- Implement a cost-effective alternative which will restore the net rate of longshore sand transport.
- Stabilize Moriches and Shinnecock Inlets through a sand by-passing program.
- New inlets or breaches of the barrier island caused by storms should be closed on an emergency basis as they develop. Should the site of a new inlet include private property, such property should be condemned prior to repair to prevent development or redevelopment.
- Examine issues of finishing or removing the groin system at Westhampton beach. Recognize that any solution to maintaining the ocean shoreline at its current location and configuration will involve large expenditures of public funds. Based on studies to date, the most feasible solution will likely involve a combination of structural and non-structural measures, including land use controls and limited acquisition.

LAND USE AND DEVELOPMENT PATTERNS

- Enforce a prohibition on development and redevelopment in Coastal Erosion Hazard Areas in accordance with Article 34 of the ECL.
- Prohibit redevelopment of high density non-conforming uses which suffer storm damage equal to or exceeding 50% of structural value.
- Mitigate the effects of a tax base loss resulting from storm-induced destruction of development. For example, investigate the possibility of combining small school districts.
- Examine the use of a transfer of development rights scheme to relocate property owners in Westhampton Beach from the barrier to mainland locations.

LAND ACQUISITION STRATEGIES

- Expand local oceanfront parks to increase public access through acquisition of suitable parcels after the occurrence of a major storm.

ENVIRONMENTAL REGULATIONS

- Minimize residential density adjacent to tidal wetlands.
- Minimize bulkheading along bay shorelines, the cumulative effect of which can possibly increase tidal ranges.

THE NFIP AND FEDERAL POLICIES

- Seek to expand undeveloped coastal barrier designations under the Coastal Barrier Resources Act on storm damaged portions of the island.

EVACUATION, WARNING AND PUBLIC EDUCATION

- Provide storm evacuation contingency plans in response to a possible breach along Dune Road west of the Jessup Lane bridge.

acre plots. Approximately 5% of the area's residents reside there year-round; another 15% spend weekends at their homes throughout the year, while the remaining 80% use their homes as summer residences.

The area's natural resources include beach, dunes, tidal wetlands, maritime flora, and marine waters—both bay and ocean—of high quality. Erosion has been a significant and persistent problem since the area was severely impacted by flooding during the 1938 hurricane. The area also experienced severe flooding during the March 1962 northeast storm. As a result of this storm, the COE began work on the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project, which resulted in the construction of a series of groins located within the Village of Westhampton Beach. The project's original intent was to extend the groin field (with beach fill) west beyond its present location to Moriches Inlet. This, however, did not occur. The incompleted project has apparently exacerbated the erosion problem along the 700 and 800 blocks of Dune Road. The area impacted again by the northeast storms of February 1978 and March 1984 (see Fig. 3-29).

In spite of the obvious and persistent erosion and flooding problems experienced in the area, pressure to develop vacant parcels continues unabated. Indeed, individuals whose homes have been destroyed by flooding and erosion have been seeking to rebuild in the same location. Insurance claims for flood-related losses in Westhampton Beach since 1977 are the highest on Suffolk County's south shore. The structural value at risk for houses in the study area totals approximately $25 million (based on equalized town assessment values). Although there are only approximately 10 year-round residents at risk, there are approximately 1300 seasonal residents at risk during the hurricane-prone months of June, July, August and September (Table 3-13).

The area was chosen for detailed study for several reasons:

- the serious nature of the flooding problem and the significant losses incurred thus far
- the potential for extraordinary losses in the future
- the potential to create open space in a flood prone area
- the need to limit Federal, State and local expenditures in an area vulnerable to flooding

Fig. 3-30 shows the boundaries of the Westhampton Beach detailed study area.

The shoreline in the western end of the study area at Moriches Inlet has also demonstrated dramatic changes in recent years (Kassner and Black, 1982). Figures 3-31 through 3-34 show Moriches Inlet at various dates from 1947 to 1980. Attempts to stabilize the Inlet with jetties, as well as the dredging of navigational channels to the Inlet, have resulted in modifications of sedimentation patterns both along the oceanfront and in the lagoon tidal delta. In January 1980, the shoreline immediately to the east of the east jetty at the Inlet was breached. The breach was subsequently closed by the Corps of Engineers under an emergency project to prevent potential storm-induced flooding along the shores of Moriches Bay.

TABLE 3-13

Population at Risk in the Westhampton Beach Detailed Study Area

Census Block	Structure Count	Avg. Year-round Residents Per Household	No. of Struct. Housing Year-round Residents	Total Year-round Residents	No. of Struct. Used Seasonally	Avg. Seasonal Residents Per Household	Total Seasonal Residents
801	129	1.6	3	5	126	5.5	693
804	102	2.5	2	5	100	5.5	550
802	11	2.0	—	—	11	5.5	61
				10			1,304

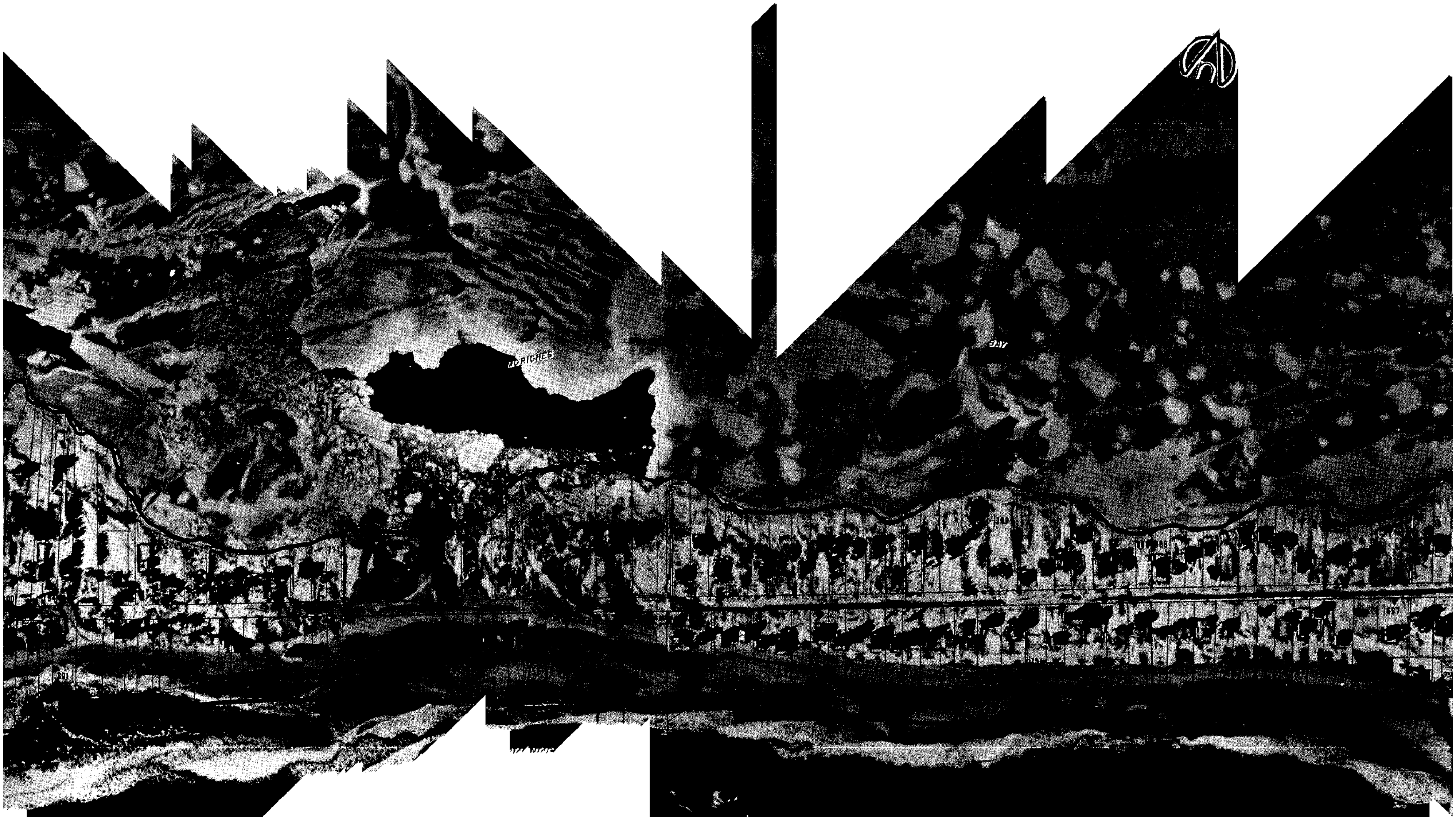
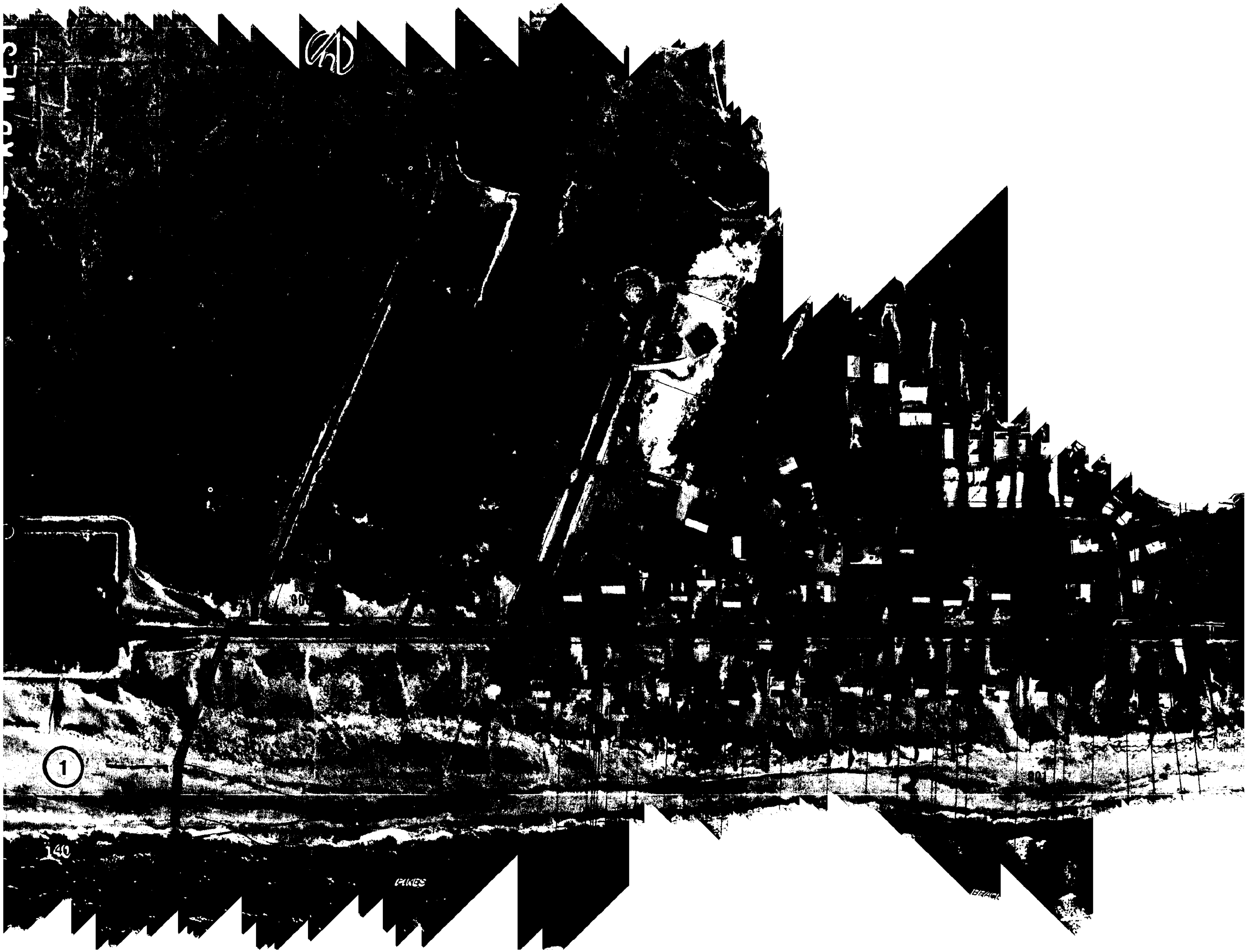
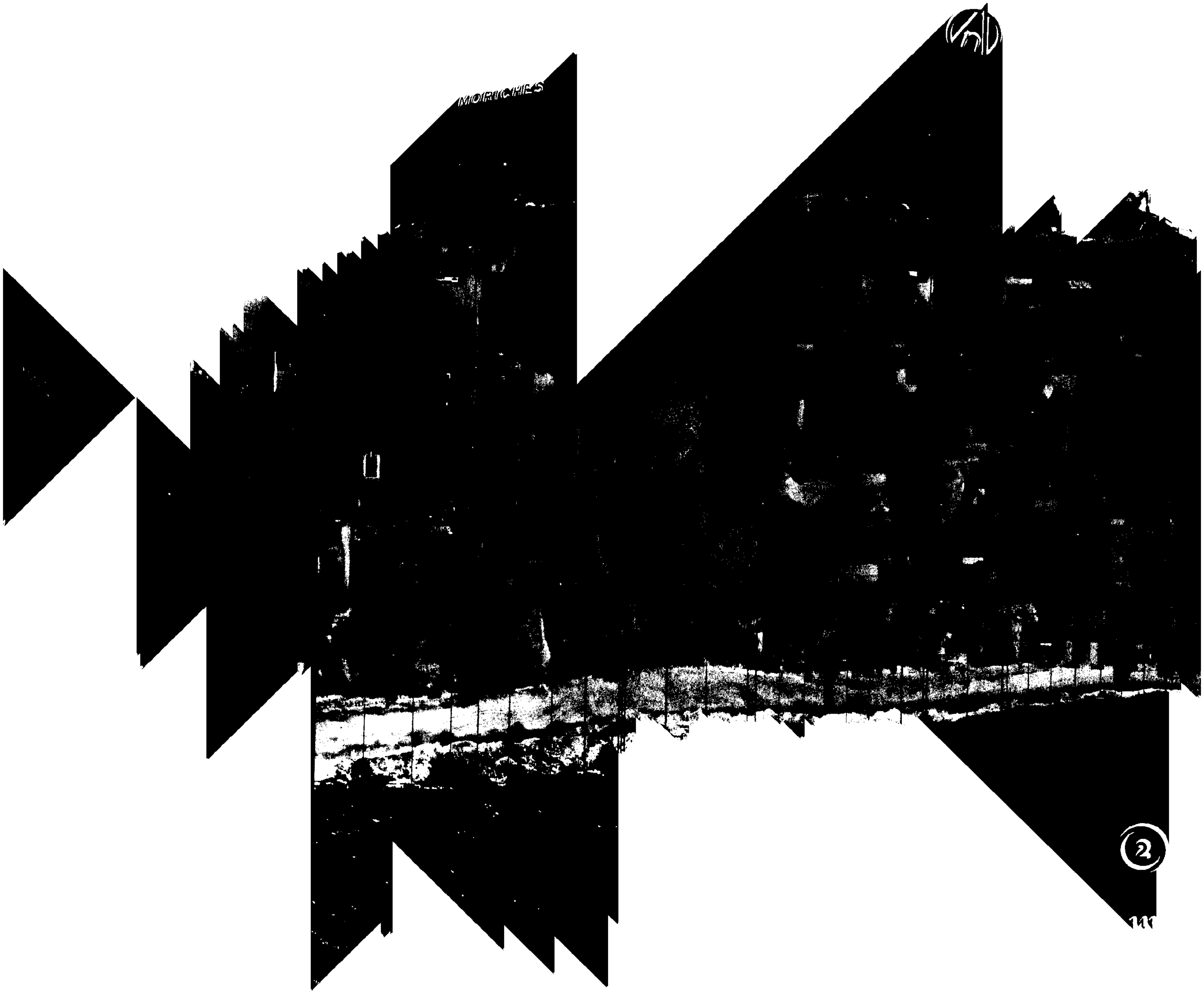
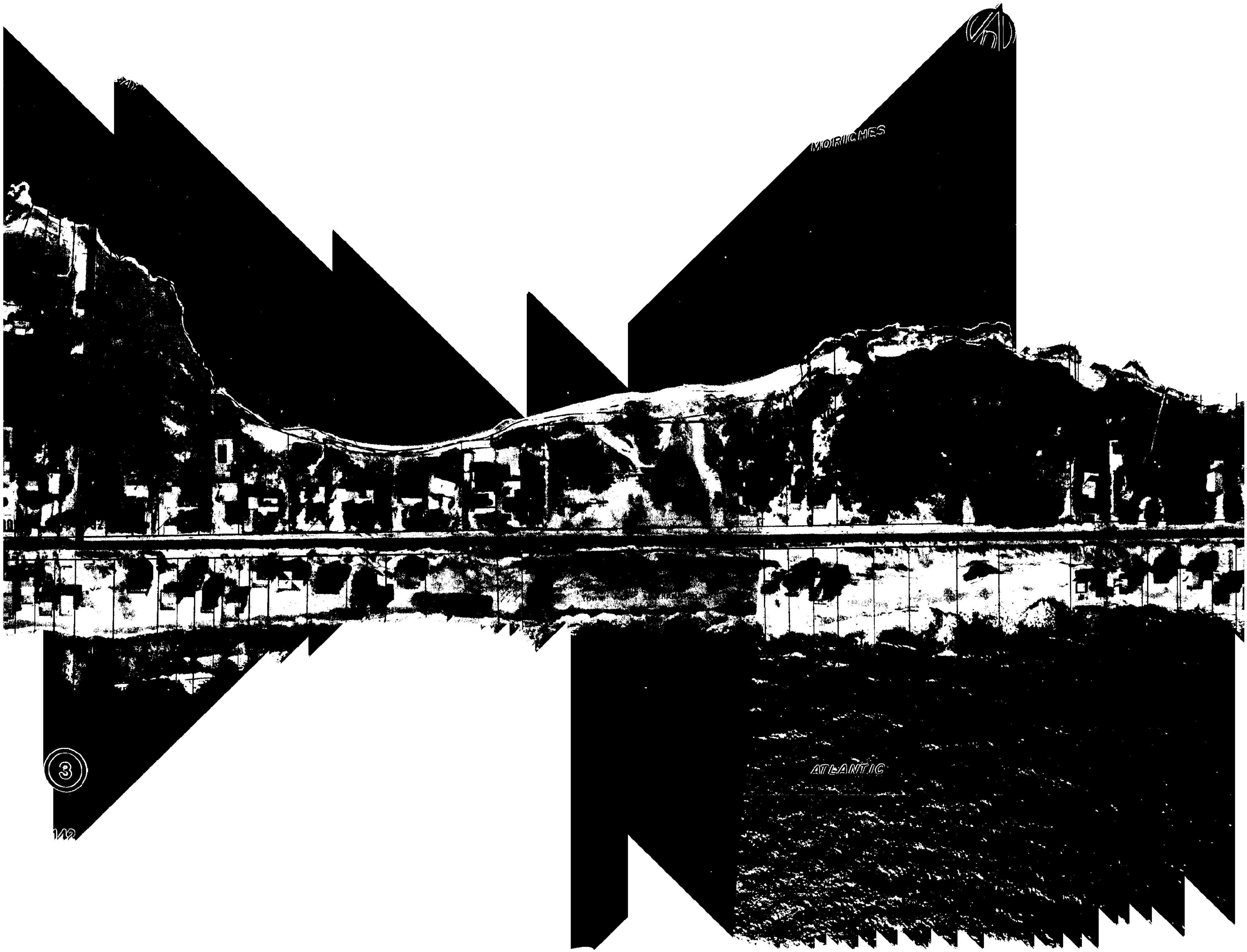


Figure 3-29
Extensive dune line recession and overwash of the barrier at Westhampton Beach resulting from the February 1978 northeast storm


East Moriches
Westhampton
Moriches Bay
Moriches Inlet
1
2
3
4
Atlantic Ocean
KEY AERIAL
Study Area
WESTHAMPTON BEACH

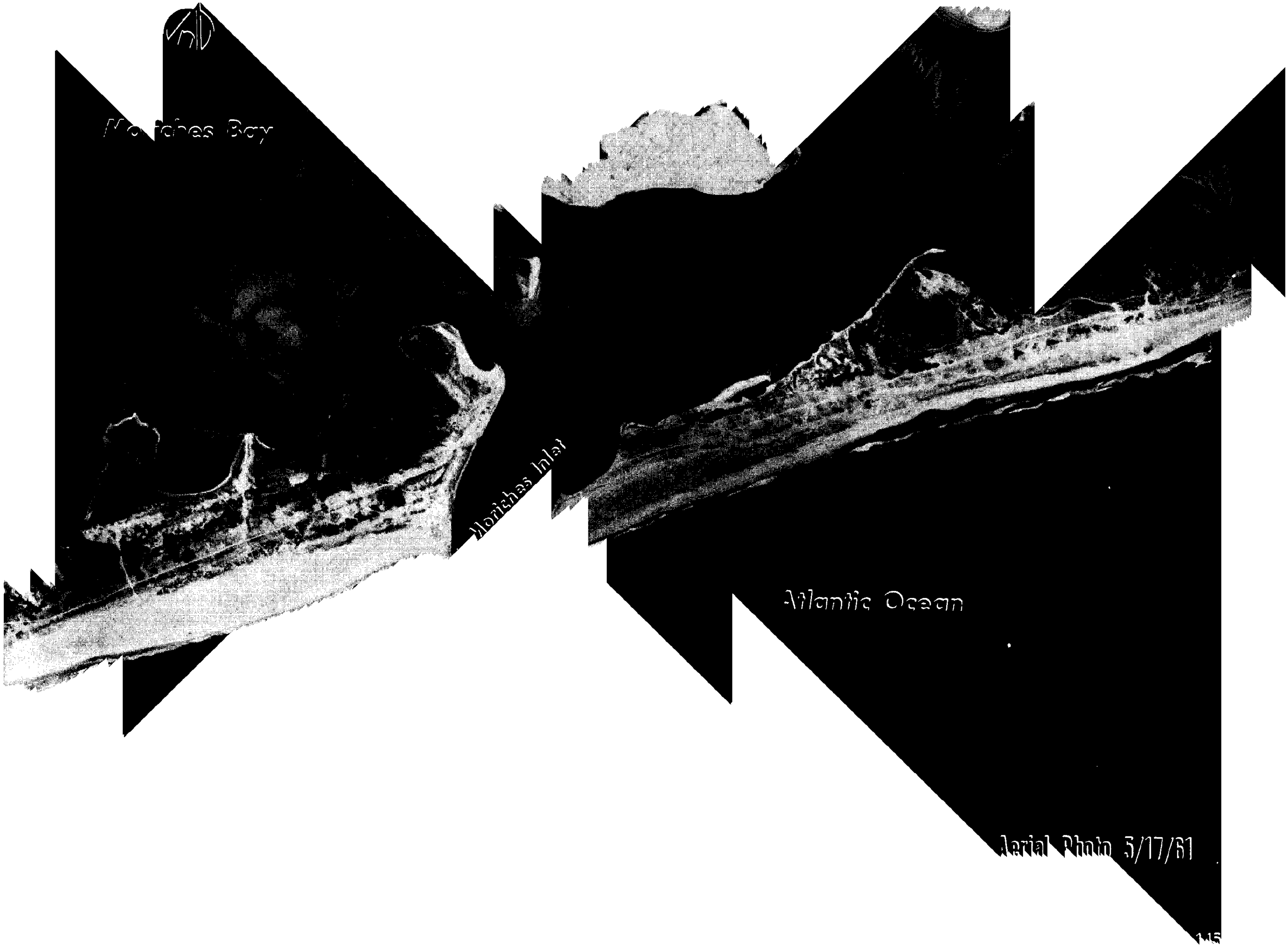

1
140
PINES


MORICHES
2


MORICHES
ATLANTIC
3
142

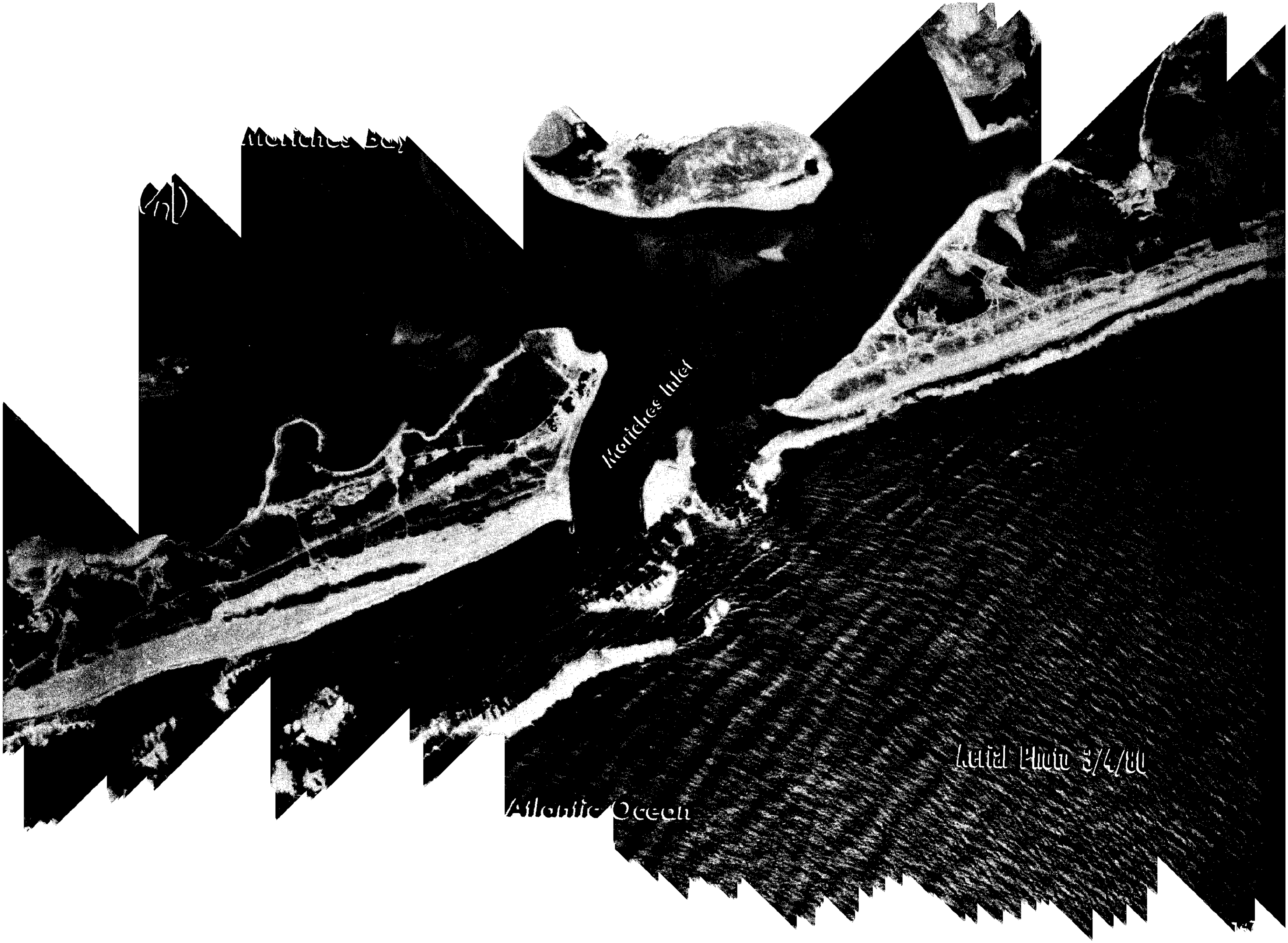
701
OUNTY
OF
FFOLK
4


Moriches Bay
Moriches Inlet
Atlantic Ocean
Aerial Photo 9/23/47



Moriches Bay
Moriches Inlet
Atlantic Ocean
Aerial Photo 5/17/61


Moriches Bay
Moriches Inlet
Atlantic
Photo 4/8/74


Moriches Bay
Moriches Inlet
Atlantic Ocean
Aerial Photo 3/4/80

3.5.1.2 Westhampton Beach Strategies. Strategies for the Westhampton Beach study area must address both short-term problems as erosion threatens individual houses, and long-term problems pertaining to the integrity of the barrier island. A solution to the problems of Westhampton Beach could include a combination of both structural and non-structural alternatives. Long-term solutions will likely involve large public expenditures.

- Decisions regarding the final choice of a structural solution should be based on a comprehensive analysis of the advantages and disadvantages of each, including scientific, engineering, economic and social issues. Many important knowledge gaps remain to be filled.
- Interim structural strategies include the emergency closure of any new inlets that breach the barrier beach. Such action is necessary to retain access to properties located on the barrier as well as the public recreational facility at Cupsogue Beach. Should the site of a new inlet include private property, such property should be condemned prior to repair of the breach.
- Non-structural strategies along this reach include the public acquisition of properties after substantial structural damage occurs. National Flood Insurance programs, such as Section 1362, or the presently defunct constructive total loss program should be used to purchase properties, in conjunction with local funds. This strategy should be instituted over the short-term as damage occurs.

The detailed study area has been divided into subsections, as depicted in Fig. 3-30, based on erosion patterns and loss of structures resulting from previous storm events. Subsection 1 appears to be the most threatened portion of the detailed study area; 11 houses have been lost to storm-related erosion since December 1982 and many others are in imminent danger. (See Figs. 3-35 and 3-36.) There are no dunes protecting the homes, and washovers from the ocean to the bay have occurred in a few locations. Subsection 2 appears to be somewhat less threatened by erosion because it is located north of Dune Road. The ocean has, however, approached the homes in this subsection, resulting in the deposit of 3 ft of sand and debris on Dune Road (Fig. 3-37). Subsection 3 appears to be somewhat less vulnerable than 1 and 2 because lots have greater depth and a dune system fronts the houses. Subsection 4 is probably the least vulnerable within the detailed study area; it is on the north side of Dune Road, lots are generally deep, and overwash has not recently occurred there. (See Fig. 3-38.)

All levels of government should focus their attention on mitigating the impacts of erosion in subsections 1 and 2. It is recommended that as houses suffer damage greater than 50% of structural value, the land should be condemned and purchased by appropriate levels of government after flood insurance claims are paid by FEMA.

Over the long-term, however, hurricanes pose the greatest threat to the entire study area. The hurricane of 1938 destroyed virtually all houses in this area. In a post-storm situation, government should stabilize the barrier, prohibit redevelopment, and purchase the land.

The erosion problem within the detailed study area has been exacerbated by the failure to complete the groin system. It may not be necessary to complete the project in its original scope; however, it appears that a structural alternative will be necessary to restore the natural longshore transport of sand and to protect the mainland and bay environments. It has been estimated by the COE that the cost of the proposed structural alternatives for beach erosion control within the detailed study area will range from $50-$75 million.

It should be noted, however, that this estimate does not include approximately $9.8 million spent thus far to nourish beaches, build dunes and construct groins. Nor does it include future maintenance costs. Table 3-14 summarizes the history of expenditures for shoreline protection projects as well as proposed COE shoreline protection projects on the Westhampton barrier island. The total cost of additional COE projects on the Westhampton barrier island is between $125 and $175 million.

The non-structural alternative, which involves purchase of homes and property by appropriate units of government, will probably cost at least $25 million based on equalized assessment values. A modified structural solution will be necessary to provide a minimal level of stabilization on the barrier island and the non-structural alternative will be necessary to protect lives and limit future government expenditures in post-storm situations.

The value of flood insurance policies currently in effect in the detailed study area totals at least $22.6 million. It should be noted that this value represents the value of policies on 160 out

Figure 3-35
Westhampton Beach–
Damaged house on beach in Subsection 1

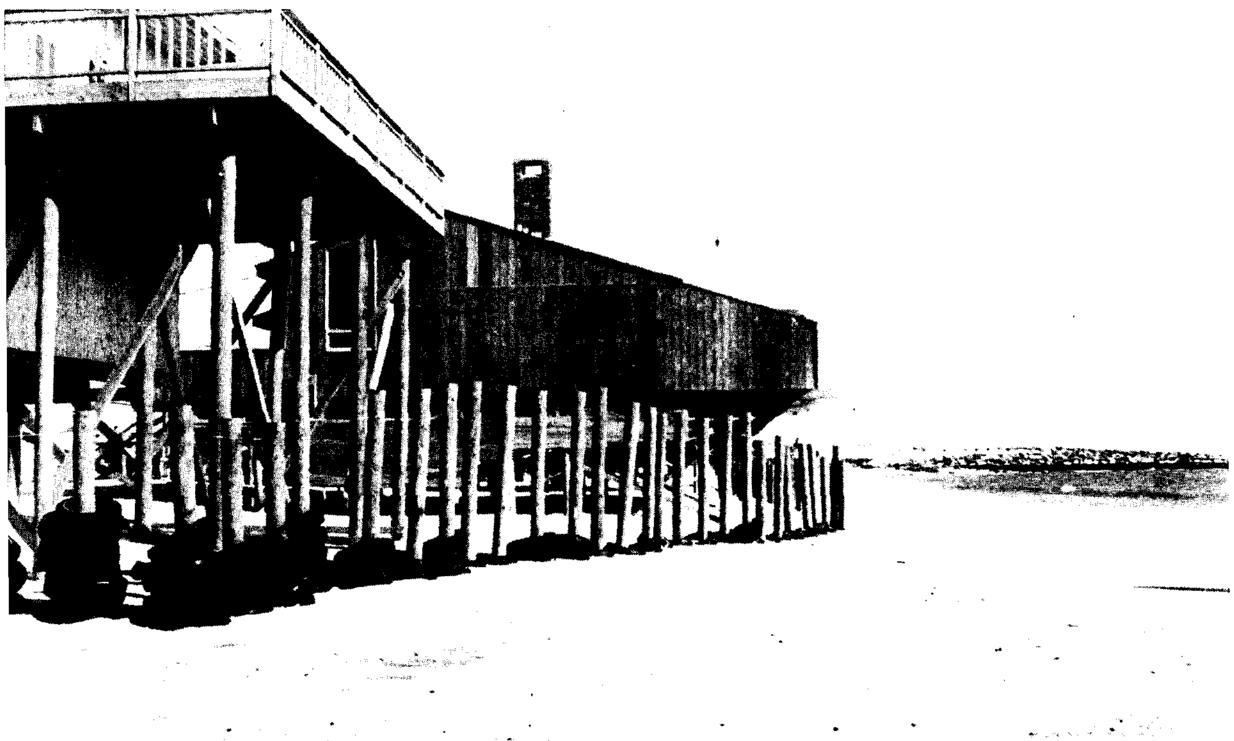


Figure 3-36
Westhampton Beach–
Attempt by shorefront residents to protect homes from wave action

Figure 3-37
Westhampton Beach–
View of Dune Rd. west of the last groin prior to the northeast storm of 29 March, 1984

Figure 3-38
Westhampton Beach–
Homes on bay side of Dune Rd.

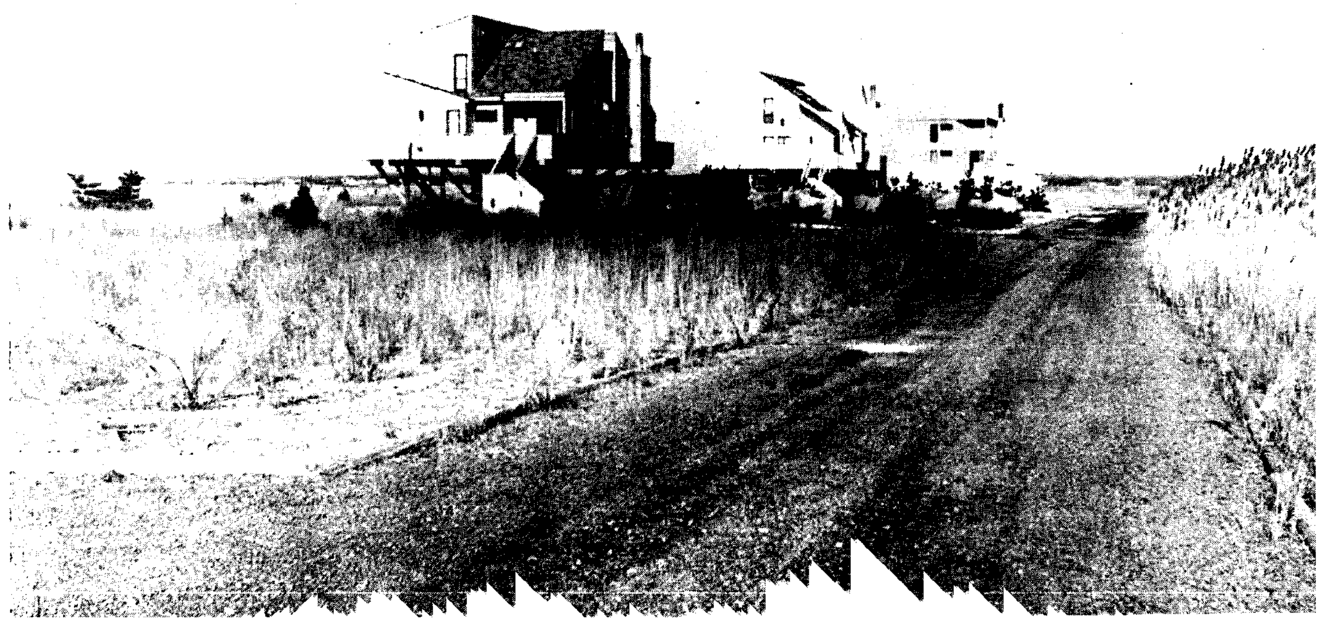


TABLE 3-14

Westhampton Barrier Island: Shoreline Construction History

Project	Date of Study or Authorization	Description	Area	% Complete	Cost (Reference)
Federal-U.S. Army Corps of Engineers					
1. a. Phase I–Fire Island Inlet to Montauk Pt. Beach Erosion Control and Hurricane Protection	1960a	11 stone groins constructed in 1966; 4 additional groins constructed in 1970; 2 million yd^3 of sand used to fill in groin field and rebuild beach.	3.5 miles	100%	$6,000,000 (a)
b. Phase II–Interim Project at Westhampton Beach	1977s	4 million yd^3 to fill existing groin field; 4 million yd^3 to nourish beach west of western-most groin–widen beach to 100 ft., increase dune to 16 ft.	2 miles	0%	$50-75 million (d) (proposed) (1984 Cost Estimate)
c. Phase III	1977s	Beach and dune construction for remainder of Island; up to 8 additional groins are authorized.	12 miles	0%	$55-80 million (d) (proposed) (1984 Cost Estimate)
2. Emergency Shore Protection	1962i	Repair of beach and dune erosion; 370,000 yds. of sand filled.	5 miles	100%	$970,000 (a)
3. Moriches Inlet Channel Improvement	1960s	Excavate entrance channel, inner channel, repair existing jetties, construct 300 ft. deposition basin, place dredged sand downdrift of inlet.		0%	$20,000,000 (b) (proposed) (1984 Cost Estimate)
4. Emergency Fill Project	1983i	1600 ft. stone revetement built and sand filled.		100%	$1,500,000 (e) (70% Fed.)
5. Emergency Shore Protection	1984i	Dune Road rebuilt and 125,000 yd^3 used to create dune protection.	1.3 miles	Anticipated Completion 6/84	$900,000 (Anticipated Cost)
State and Local					
1. Emergency Dune Repair	1938i	Dune fill by Suffolk County following hurricane of 1938; bulkheading on west side of Shinnecock to stabilize inlet.		100%	$180,000 (c)
2. Westhampton Beach	1951i	Dune fill and beach grass to close inlet formed by storm.		100%	$193,000 (c)
3. Westhampton Beach	1958i 1967i	380,000 yd^3 and 250,000 yd^3 of dune fill.		100%	$184,300 (c)
4. Westhampton Beach	1983i	Emergency bulldozing of sand to open and maintain Dune Road.		100%	$40,000 (c)

References

(a) North Atlantic Division, 1977
(b) North Atlantic Division, 1981
(c) NYS Conservation Department, 1968
(d) Bergman, B., and S. Calisi, New York District, U.S. Army Corps of Engineers. Personal Communication, May 4, 1984
(e) Gilman, J., NYSDEC. Personal Communication, March 19, 1984

a–authorization date
s–study date
i–implementation date

of a total of 242 homes. Some homes may not be covered by flood insurance; however, many of the remaining 82 homes probably do have flood insurance, but the addresses are not included on the policies, and thus will not appear on the computer printout* which lists policies. The average value of a flood insurance policy in the detailed study area is approximately $141,400. If this value is applied to the remaining 82 homes, it is estimated that an additional $11.6 million in flood insurance could be in effect. Thus, an estimate of the total value of flood insurance coverage would be $34.2 million.

A comparison of the non-structural alternative (payment of flood insurance claims for destroyed structures followed by the purchase of land) with the COE proposed structural alternative (COE interim project at Westhampton Beach) reveals that significant cost savings of at least $25 million will be realized by implementing the non-structural alternative. This savings does not include the additional liabilities FEMA and ultimately the taxpayer would bear if FEMA does not seek changes in the NFIP and once again insures structures in a **V** zone. Thus, it is envisioned that the non-structural alternative will not require future and increasing government expenditures beyond the satisfaction of flood insurance claims, purchase of land and minimal beach stabilization efforts.

Table 3-15 lists the full value assessment of the land and improvements as determined by the Town of Southampton, and the combined total by subsection; the addresses and the number of structures included within each subsection are also shown. Table 3-15 also lists the value of structures by subsection based upon an analysis conducted in 1983 for the COE for its reformulation study on the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project (URS Company, Inc., 1982). It is noteworthy that the assessed values and the COE estimates compare favorably in three of four subsections. The larger discrepancy in the fourth subsection is probably due to older town assessments, which are less accurate. The total equalized assessed value of land and improvements is approximately $22 million. Thus, the COE (in its 1977 proposed interim project at Westhampton Beach) is proposing to spend $50-$75 million to protect homes and property in the detailed study area valued at approximately $22-$25 million. It should be noted, however, that the COE project is also designed to provide benefits to the mainland shoreline as well.

Should a hurricane or severe northeast storm event destroy all or most of the homes in subsection 1, FEMA will probably face $5.7 million in flood insurance claims. New York State, Suffolk County and Southampton Town would share the $2.7 million of land acquisition costs (assuming the equalized assessed value closely approximates market value) if the decision were made by these units of government to acquire this land. Again, it is emphasized that FEMA should seek modification of the NFIP to permit homeowners in a **V** zone to receive only a one-time recovery on the value of the structure up to the flood insurance policy limits. Once the claim is paid by FEMA, the homeowner would no longer be eligible for flood insurance.

The Southampton Town master plan and waterfront revitalization plan recommends the acquisition of ocean facilities west of the Village of Westhampton Beach. This can be accomplished by the purchase of vacant property immediately east of the existing town beach and parking lot.

In addition to acquisition costs, government must consider the impact of property tax revenue lost as property is acquired by government and taken off the tax rolls. Table 3-16 lists the property tax revenue generated for the Town, County and Remsenberg/Speonk School District.** Homes and property in the detailed study area in 1983 generated a total of $382,174 per year in property taxes. Suffolk County would lose $67,907 or approximately 0.8% of the County property tax revenue generated in Southampton Town. Southampton Town would lose $121,707 or approximately 0.9% of the total town property tax revenue. The Remsenberg/Speonk School District would be the most severely impacted taxing entity. The district would lose $182,792 in taxes, or approximately 15% of its total property tax revenue. It is anticipated, however, that this revenue loss could be offset by the expansion of the tax base that is occurring on the mainland. The Ocean Bay-Dune Road West Fire District would lose $9768 in revenue, or approximately 56% of its property tax revenue. It should be noted, however, that the district contracts for fire protection services, which would be reduced as a result of the purchase of property and elimination of re-building, thus minimizing the impact of revenue loss. The revenue losses described as-

* FEMA data listing the value of flood insurance policies in effect in the Nassau/Suffolk region as of 1983.

**Personal communication, Mr. Gary M. Simonson, Southampton Town Assessor.

TABLE 3-15

Full Value Assessment* of Land and Improvements in the Westhampton Beach Detailed Study Area

Subsection	Addresses	No. of Structures	Full Value Assessment Land	Improvements	Total	Avg. Assess. Value of Structures	C.O.E. Estimate of Structural Value
1	667-859 662-686	89	$2,653,290.	$5,779,460.	$8,432,750.	$75,057.	$6,274,874.
2	688-792	34	962,553.	2,161,418.	3,123,971.	63,571.	2,205,000.
3	861-963	34	1,247,659.	1,876,879.	3,124,538.	55,202.	1,995,000.
4	794-902 Dune Lane Cove Lane	85	1,441,134.	5,869,148.	7,310,282.	69,049.	7,169,000.
TOTAL		242	$6,304,636.	$15,686,905.	$21,991,541.		$17,643,874.

TAX RATES PER $100 OF ASSESSED VALUE: County = 4.38; Town = 7.85; School Dist. = 11.79; Fire Dist. (Ocean Bay - Dune Rd. West) = .63

*Equalization Rate of .0705 applied to yield full value.

TABLE 3-16

Property Tax Contributions of Homes in Westhampton Beach Detailed Study Area

	County Property/Tax Revenue Generated in Detailed Study Area		Town Property Tax Revenue		Remsenberg/Speonk School District Property Tax Revenue		Ocean Bay-Dune Rd. West Fire District Property Tax Revenue	
Subsection	Revenue/ Subsection	% of Total County Revenue Within Southampton Town	Town Total	% of Total	Sch. Dist. Total	% of Total	Fire Dist. Total	% of Total
1	$26,039	.3%	$46,669	.4%	$70,092	5.8%	$3745	21%
2	9,647	.1%	17,289	.1%	25,966	2.1%	1388	8%
3	9,648	.1%	17,292	.1%	25,971	2.1%	1388	8%
4	22,573	.3%	40,457	.3%	60,763	5.0%	3247	19%
	$67,907	.8%	$121,707	.9%	$182,792	15.0%	$9768	56%

sume that all homes in the detailed study area would be lost at once after occurrence of a hurricane. The impacts would be significantly less severe if purchase of homes and land were phased over a period of years.

- The Town of Southampton moratorium on development along the oceanfront in this study area should be continued until conditions dictate otherwise.

The storm of 29 March 1984 has left approximately 150 homes extremely vulnerable. Water washes under the homes at high tide. Approximately 20 oceanfront lots remain undeveloped. The moratorium instituted by the Town of Southampton on development of vacant parcels, and the re-construction of dwellings which suffer damage equal to or exceeding 50% of structural value, should remain in effect under current conditions. Additional construction would result in placing more property at risk should the full force of a hurricane strike the area.

3.6 SHINNECOCK INLET TO MONTAUK POINT: REACH PROBLEMS AND STRATEGIES

The easternmost reach in the study area is characterized by a natural shoreline. The first several miles consist of a narrow barrier spit—Southampton barrier beach—with irregular dunes up to 30 ft in height. The rest of the reach consists of mainland, unprotected by a barrier beach. The beaches are quite narrow, with less extensive dunes than the barrier beaches to the west. (See Fig. 3-39.) The last 10 miles of the reach consist of steep, bluffed headlands with elevations up to 70 ft.

Both the barrier spit portion and the headlands bluff portion are subject to severe erosion. Shoreline protection structures—including gabions at Montauk Point, groins at East Hampton, and stone revetments at various locations—have been built to protect shoreline property. This erosion threatens the high value, but relatively low density residential housing

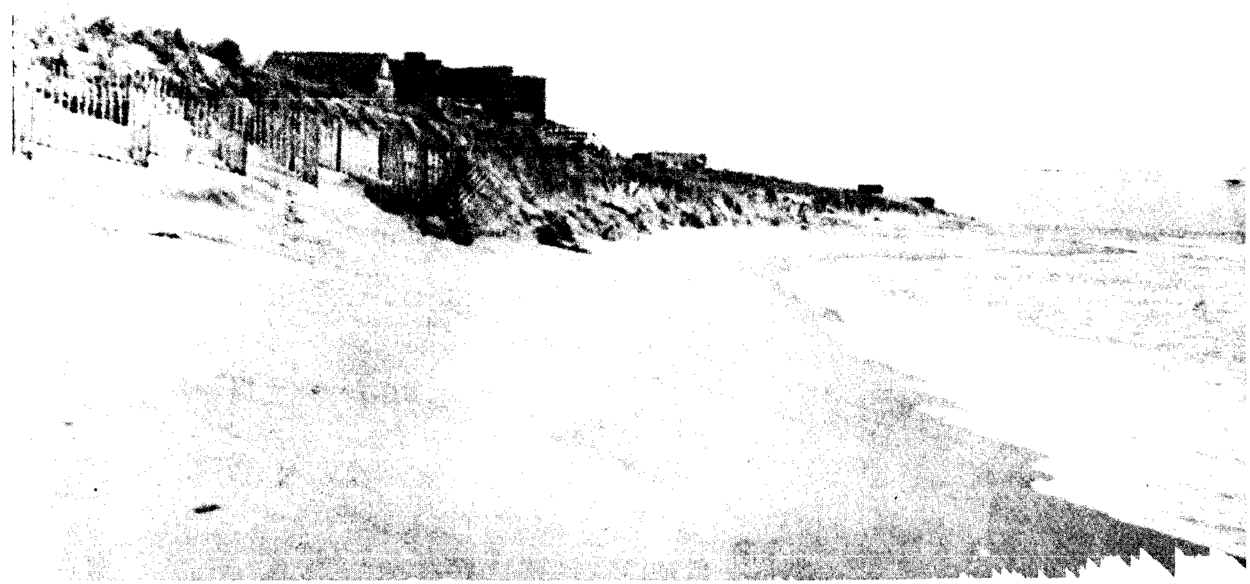


Figure 3-39
Oceanfront houses built behind dunes fronting on narrow beach

along the coast. There are considerable pockets of residential development at risk at Montauk Beach, Amagansett and Napeague. Because of the narrowness of the beach and the height of the bluffs in the eastern portion of the reach, most of the development there is elevated safely out of the floodplain. There are large recreation areas located in this portion, including Napeague, Hither Hills, and Montauk State Parks.

There is extensive pressure for new residential and commercial development in the remaining vacant portions of the flood hazard areas. In light of recent trends, it is possible that the owners of newly constructed motels will seek conversion to individual residential ownership at a later date. The expanding seasonal population and tourism industry will continue to create development pressures for this reach.

Evacuation of the eastern end of the south fork is a particular concern because of the limited carrying capacity of Montauk Highway—the reach's only major east-west transportation corridor—and the potential for an overwash of the highway at Napeague, which would effectively cut off all land-based evacuation routes for the Montauk peninsula. The potential for flooding is particularly high at Napeague because the area is low-lying, narrow, and fronted by small irregular dunes. Recommended strategies for this reach are presented in Table 3-17.

3.6.1 Napeague Detailed Study Area

3.6.1.1 General Description and Problem Statement. Napeague was chosen as the detailed study area for the Shinnecock Inlet to Montauk Point reach. The Napeague study area is bordered by Napeague Bay to the north and the Atlantic Ocean to the south. The western boundary is a straight line from Cherry Point through the Napeague Meadow Road/Lazy Point Road interchange to the ocean. The eastern boundary is the western edge of Hither Hills State Park. (See Fig. 3-40.)

A large percentage of this area is publicly owned by New York State and under the jurisdiction of the Long Island State Park and Recreation Commission (LISPRC). Much of the State land north of Montauk Highway is designated by NYSDEC as tidal wetlands and has not yet been developed for recreation uses. The State parklands south of Montauk Highway include a large undevel-

TABLE 3-17

Shinnecock to Montauk Reach Strategies

EROSION AND FLOOD CONTROL MEASURES

- Accept the natural shoreline regression along the headlands portion of the reach as beyond practical control.
- Minimize public investments to stabilize the barrier beach portion of the reach.
- Close any breach that may form along the barrier spit east of Shinnecock Inlet. Should the site of the breach include private property, such property should be condemned prior to repair to prevent development or redevelopment.

LAND USE AND DEVELOPMENT PATTERNS

- Limit public investments in infrastructure to coastal dependent uses only. Avoid public investments which may increase development pressures within the 100-year floodplain.
- Encourage the use of clustering techniques to keep development away from hazardous areas and preserve open space.

LAND ACQUISITION STRATEGIES

- Expand public open space in areas vulnerable to overwash and flood damage.

THE NFIP AND FEDERAL POLICIES

- Seek to expand undeveloped coastal barrier designations under the Coastal Barrier Resources Act on storm-damaged portions of the island.

EVACUATION, WARNING AND PUBLIC EDUCATION

- Develop plans for emergency response procedures in the event of a breach at Napeague.

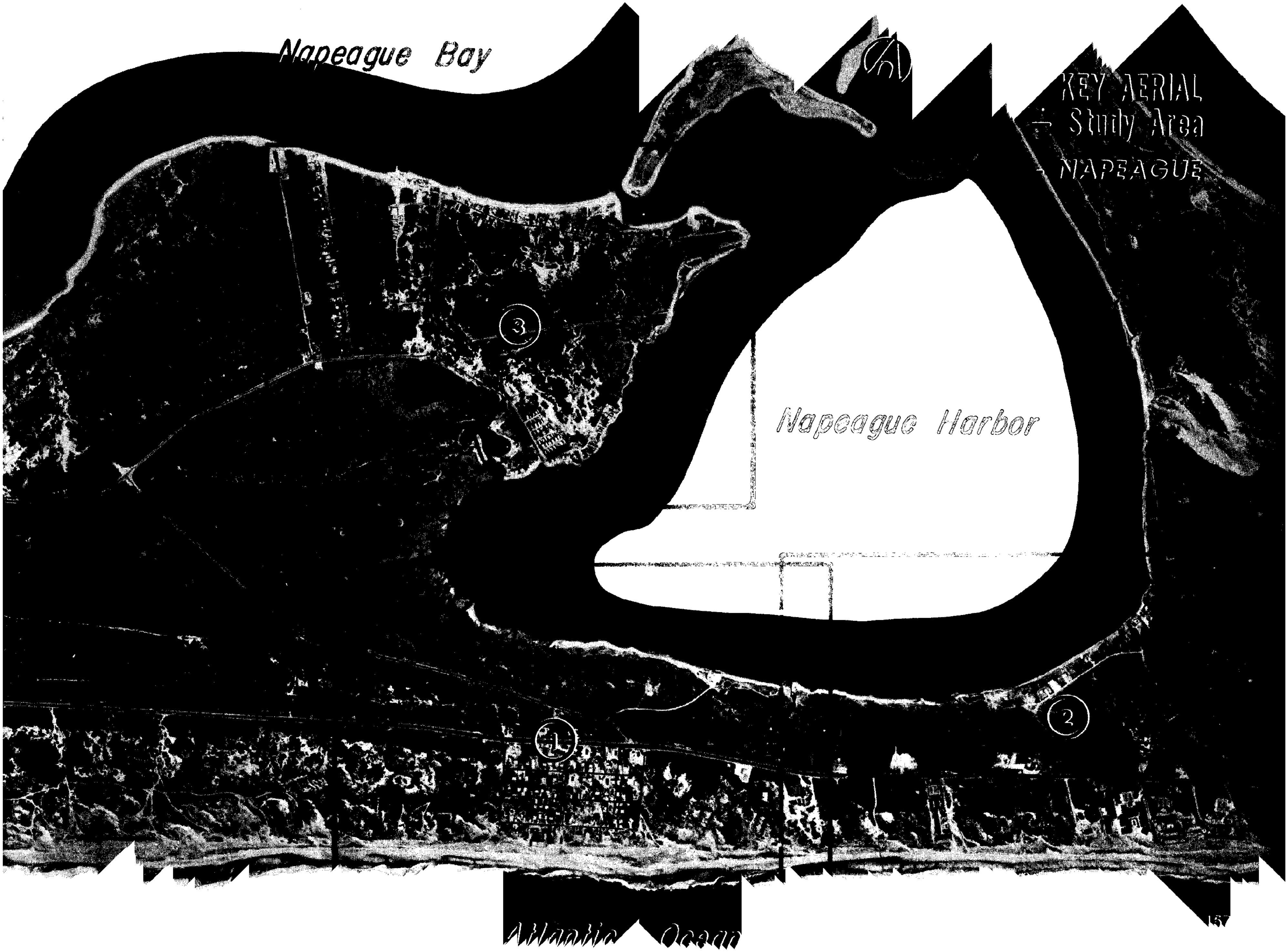
oped segment of ocean beach with an extensive natural dune system.

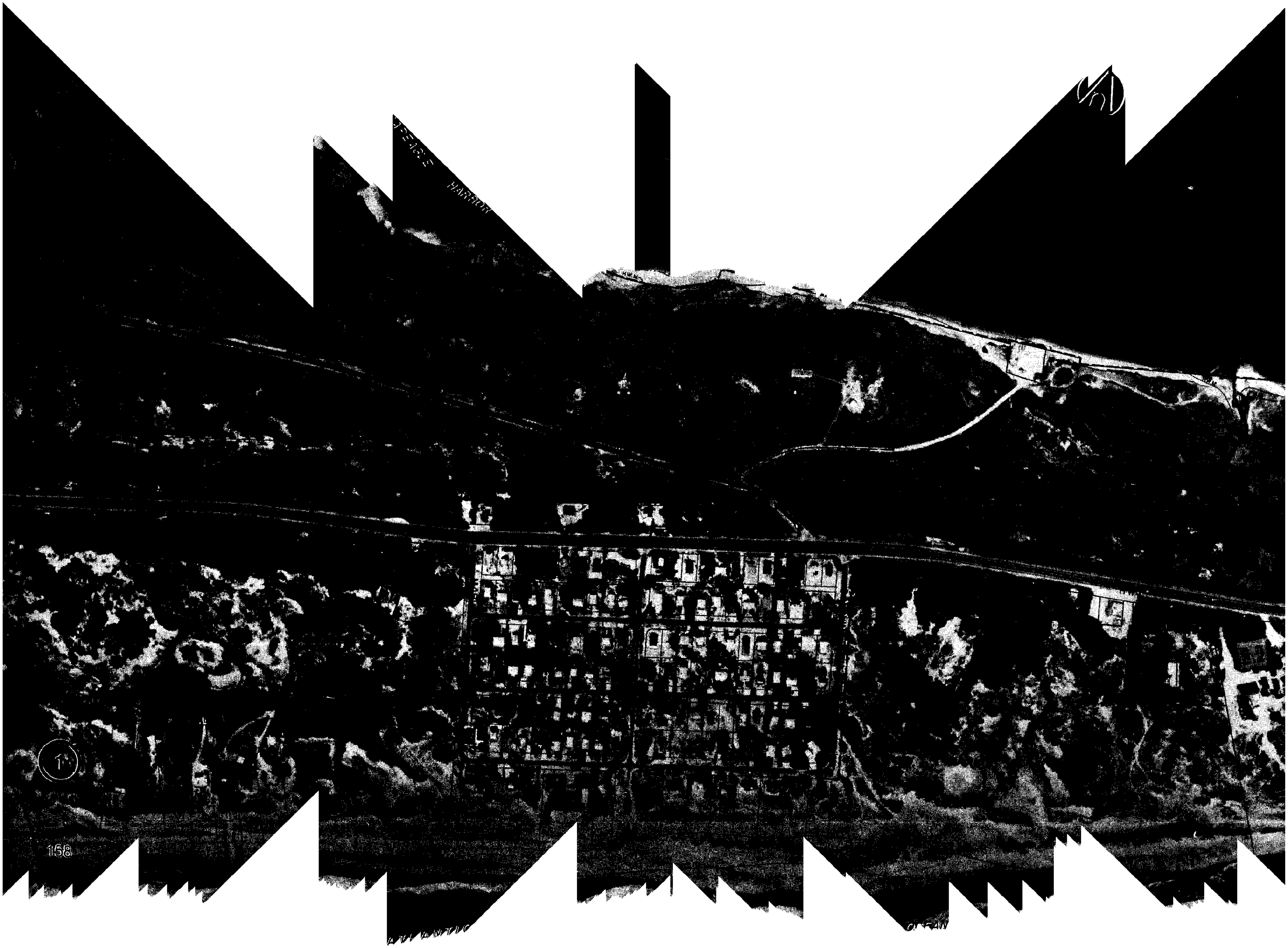
The Trustees of the Freeholders and Commonalty of the Town of East Hampton also own land within the study area, including a large area at and around Lazy Point. The majority of this land is undeveloped; however, part of this land, is leased by the Trustees to seasonal and year-round residents on an annual basis. In addition to the limited single-family residential development at Lazy Point, there is a small seasonal community of approximately 100 single-family houses south of Montauk Highway. Most of the structures in this seasonal community, as well as those located at Lazy Point, were constructed prior to the enactment of the Town's Special Flood Hazard Overlay District in 1976 and thus, are not elevated or constructed to conform to the provisions specified in the ordinance. (See Fig. 3-41.) There are also several high density motel and cooperative/condominium developments south of Montauk Highway along the ocean (Fig. 3-42). However, the Town of East Hampton has amended its zoning ordinance to reduce the size of the multiple residence district at Napeague, thereby limiting additional high density development at this area. Most of the area that was formerly in the multiple residence district has been changed to limit residential density to one structure per two acres. There is also a town-wide moratorium on development greater than five units per acre currently in effect.

Essentially all of the land within this study area is within the 100-year floodplain, and a significant number of structures are located in the **V** zone. The area was almost completely flooded during the 1938 hurricane, and suffered extensive flooding during the storms of March and April, 1984. Erosion of the ocean shoreline is a gradual, but not a critical problem in this study area. The greatest threat remains from bay side flooding; the narrow land area between Napeague Harbor and the Atlantic Ocean is particularly vulnerable to overwashes in the event of a storm, which isolates the Montauk peninsula and blocks the lone road access along Montauk Highway.

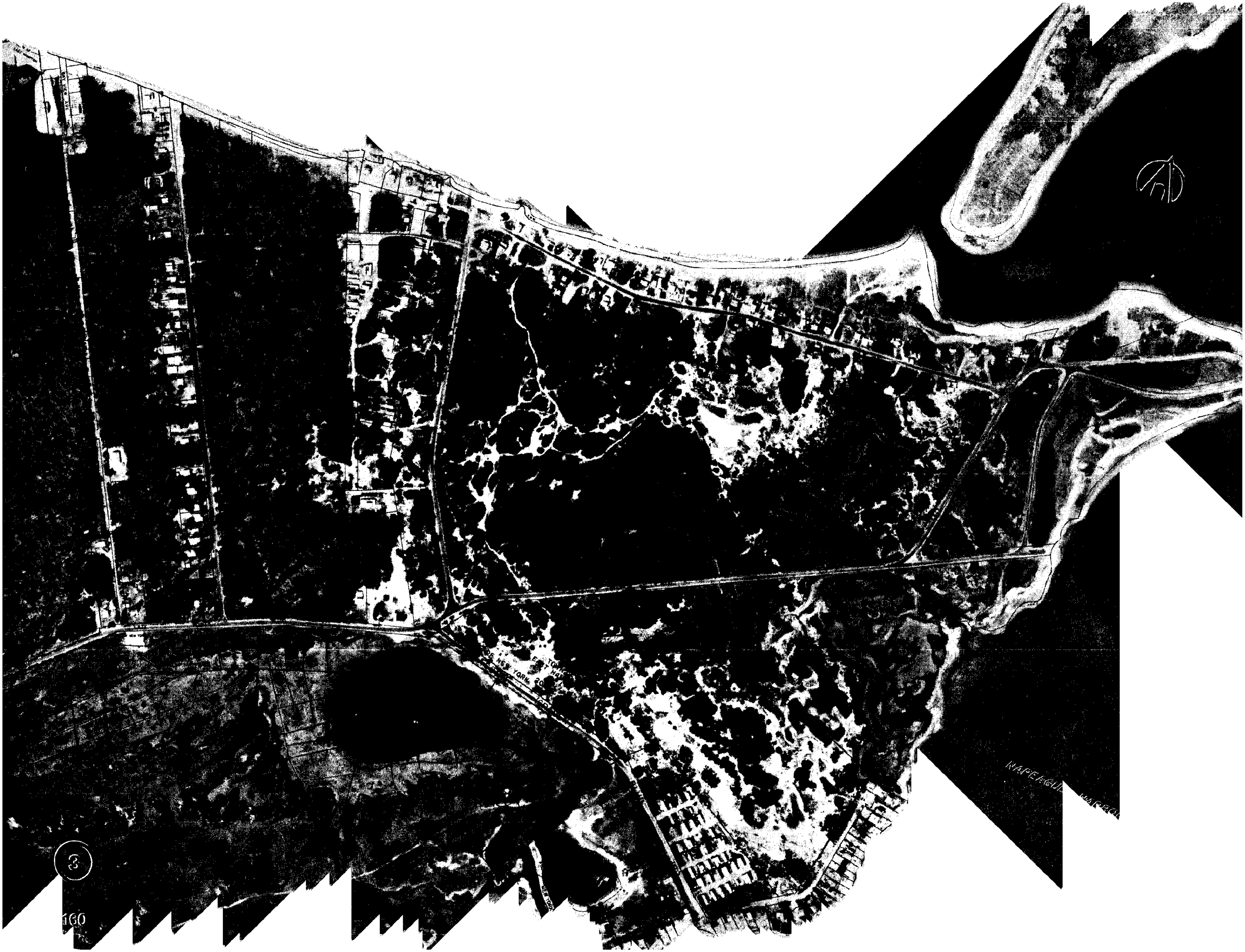
3.6.1.2 Napeague Strategies

- The multiple residence zoning district south of Montauk Highway, which includes both motel and co-op/condominiums and permits development of up to 10 D.U./acre, should not be expanded, nor should its density be increased. The low-lying nature of this area makes it susceptible to flooding, and the thin, shallow water table can be easily polluted.
- The narrow land area between Napeague Harbor and the Atlantic Ocean, which includes the multiple residence district outlined above, is highly vulnerable to washovers in the event of a hurricane. An appropriate policy for this area would be to repair and maintain dunes in areas subject to overwash.
- The structures located on Napeague Bay between Cherry Point and Lazy Point are highly vulnerable to flooding. Many of these houses are on land owned by the Trustees of the Town of East Hampton, which is leased to individual homeowners. Approximately one-half of the houses in this area appear to be year-round residences. All of the structures along the shoreline are within the 100-year floodplain. It should be public policy to severely limit any additional development in this area, and to phase out housing on the Town Trustee owned land. This land could then be retained for public access and recreational use.
- To mitigate the effects of removing the low income housing on leased property at Lazy Point, the Town of East Hampton should explore strategies to provide affordable housing opportunities to those affected low income leaseholders.
- In accordance with the Long Island Regional Element of the NYS Coastal Management Plan, accept the natural, long-term regression along the Atlantic Ocean shoreline in this area. Structural protection measures should be de-emphasized along this shoreline.
- In the publicly owned portion of this study area, which includes the State owned land south of Montauk Highway, low intensity recreational uses, such as camping, should be encouraged. Infrastructure investment, such as parking lots or pavilions, should be minimized in the 100-year floodplain.


Napeague Bay
KEY AERIAL
Study Area
NAPEAGUE
Napeague Harbor
3
1
2
Atlantic Ocean


HARBOR


2
ATLANTIC OCEAN


3
160
NAPEAGUE

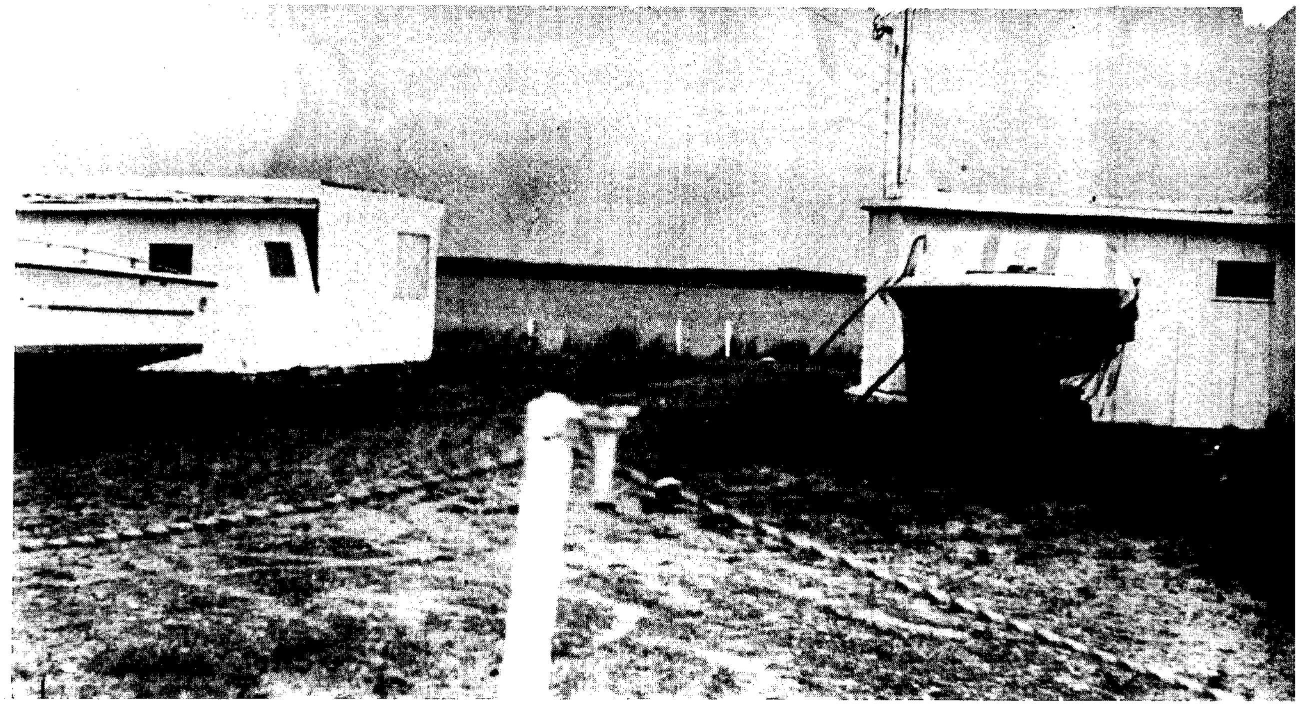


Figure 3-41
Lazy Point–
Seasonal housing having habitable floor space below base flood elevation

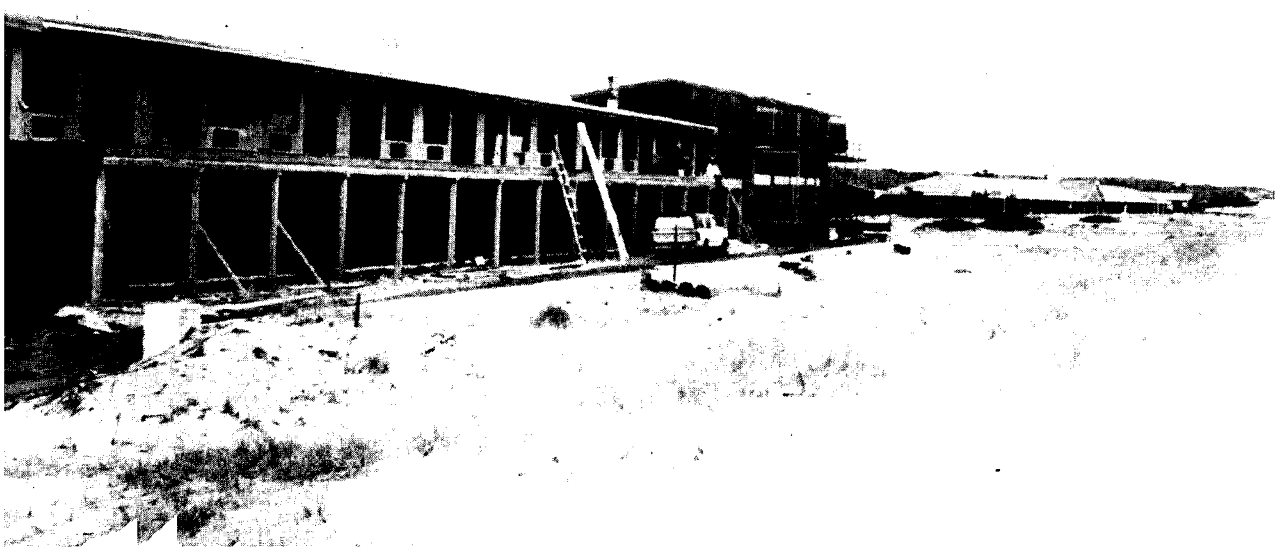


Figure 3-42
Napeague–
Oceanfront motel undergoing conversion to individual ownership

There are 54 privately owned structures located on a 75-acre parcel of land owned by the Town Trustees at Lazy Point in the Town of East Hampton. Most of the structures are situated 5 to 6 ft above msl. The base flood elevation for the 100-year floodplain is 9 ft above msl. Thus, anticipated flood depths would approximate 3 to 4 ft. Approximately 50% of these structures are used seasonally and a significant number of the leaseholders are commercial fishermen. Almost all structures are very modest in that relatively little investment in improvements has been made.

Property tax revenue generated by these structures for each taxing entity is found in Table 3-18. It is apparent from this table that property tax receipts from this area are insignificant; the various taxing entities would not be severely impacted by this loss of revenue.

The Town Trustee owned lots are leased for a one year period to Town of East Hampton residents for an annual fee of $50 per lot. The leases are routinely renewed each year. The Trustees realize a total annual rental fee of $2700 from the 54 leaseholders. Transfer of lease title requires the approval of the Town Trustees. No new leases are granted on previously unleased trustee lots. In 1935 nearly 40 residential structures were located on the publicly owned property at Lazy Point. As a result of the subdivision map of *Shore of Lazy Point, Town of East Hampton*, filed with the County Clerk on 16 September 1935 by the Trustees (listed on the map as the owners and developers), and the adoption of rules and regulations by the Trustees concerning the property at Lazy Point, the Trustees legalized the squatters position through leaseholder agreements.

TABLE 3-18

1983-84 Property Tax Contributions of Leaseholders at Lazy Point, Town of East Hampton

Taxing Jurisdiction	Tax Rate in Town of East Hampton per $1000 of Assesed Valuation	Taxes Paid by Leaseholders on Improvements Located on Town Trustee Land at Lazy Point*	Total Property Taxes Levied in Town of East Hampton by Taxing Jurisdiction	Property Tax Payment by Leaseholders as a % of Total Property Tax Levied by Taxing Jurisdiction
Suffolk County	$41.26	$2,993	$3,727,101	0.08
Town of East Hampton	$65.87	$4,779	$4,570,669	0.10
Town Highway	$23.41	$1,698	$1,624,402	0.10
Amagansett School District	$72.90	$5,289	$ 942,925	0.56
Napeague Fire Protection District	$ 9.81	$ 712	$ 29,789	2.39
TOTAL	$213.25	$15,471	$10,894,886	0.14

*There are 54 privately owned structures situated on 75 acres of Town Trustee owned land at Lazy Point. The land is assessed at $72,200 and the leaseholder improvements are assessed at $72,550.

It is recommended that the Town Trustees immediately formulate a plan to phase out the leases and remove the structures at Lazy Point. The Trustees should investigate the option of extending the leases to allow present leaseholders a chance to amortize their structural investment over a 10 year period, in exchange for leaseholder agreement that structures will not be rebuilt after sustaining damage from storm-related flooding and/or erosion equal to or exceeding 50% of structural value.

The LIRPB recognizes that the area contains a high percentage of low income families and that the displaced leaseholders will have difficulty in finding other affordable housing on the South Fork on Long Island. Therefore, the LIRPB recommends that the Trustees work closely with the the Town Board to explore options for the provision of affordable housing opportunities for displaced, low income, year-round residents at Lazy Point, such as:

- the approach taken by the Town of East Hampton at the former Montauk Air Force Base, where 27 houses were obtained by the Town from the Federal government and sold to low/middle income families for $40,000 each
- the approach taken by the Town of East Hampton with the old filed subdivision of *Olympic Heights at Three Mile Harbor,* where vacant, substandard lots were aggregated, replatted into lots that conform to existing zoning, and then sold by the Town to low/middle income families at affordable prices
- using community development funds, per the example of the Town of Southampton, to clean up and improve low income housing areas.

The Trustees should prepare a site plan for the Lazy Point property that would accommodate public access, additional parking and recreational opportunities for residents of the Town of East Hampton. Expansion of the boat ramp and parking area at Lazy Point should also be considered in the site plan in light of the fact that many of the leaseholders at Lazy Point are commercial fishermen who utilize their leasehold not only for residency, but also for drying of nets and storage of gear and boats.

Two trailer parks, one located in the **V** zone and the other in the **A** zone, are also situated on privately owned property at Lazy Point; they contain about 50 residential units. Approximately 75 additional residential structures are situated on privately owned property at Lazy Point. Nearly half of these structures are located in the **V** zone. Almost all of the structures are older dwellings that predate the Town's Special Flood Hazard Overlay District and, therefore, are not elevated or constructed to conform to the provisions specified in the ordinance. Should some or all of these structures and/or trailers be destroyed in a northeast storm or hurricane, it is recommended that the LISPRC purchase the land after FEMA has paid the flood insurance claims. The LISPRC could add this property to its adjacent Napeague parkland and therefore consolidate its holdings.

3.7 MAINLAND SHORELINE: REACH PROBLEMS

The mainland coastal reach is characterized by extensive residential development, bulkheading along the shoreline, and man-made canals. There are some undeveloped tidal wetlands and shorefront recreation areas, but the reach is predominantly developed.

Land use is almost exclusively medium density residential, with a limited amount of high density residential in Nassau County and low density residential in eastern Suffolk County. There are also scattered areas of waterfront commercial development. Most of the development along this reach is in the **A** flood zone. However, the density of this development, coupled with the fact that much of this housing stock was built prior to the enactment of the NFIP and is, thus, neither floodproofed nor elevated, creates a situation of high vulnerability to storm-induced flooding, characterized by high structural values and a high population at risk.

Because of the many north/south transportation corridors, evacuation is not considered to be a problem on the mainland. Flooding problems exist in certain areas where residential development was built on low-lying wetland areas below base flood elevations. These areas include portions of the communities of Island Park, Bay Park, Oceanside, Freeport, Amityville, Copiague, Lindenhurst, Babylon, Islip, Oakdale, Mastic Beach, and mainland areas in Westhampton Beach.

There is little vacant developable land in the western half of this reach. The objective is to steer any future development/redevelopment to inland sites where structures may be clustered, leaving the waterfront as open space. The remaining undeveloped sections of the 100-year floodplain on the eastern end of the reach should be preserved to protect the wetlands and provide a buffer zone between the upland development and adjacent wetlands and bay environments.

A problem for this reach appears to be the inconsistent requirements among communities regarding the maintenance of bulkheads. Another problem is that many of the streets and roadways along the canals and creeks of this reach were built below the base flood level, and will not only flood, but will serve as conduits for flood waters. (See Figs. 3-43 and 3-44.) The flood hazard vulnerability of this reach will probably increase greatly in the event of a storm-induced breach of the barrier island chain along the south shore.

3.7.1 Mainland Shoreline Reach Strategies. The preparation of storm hazard mitigation recommendations for the mainland shoreline, which differs both qualitatively and quantitatively from the other five coastal reaches, necessitated a different approach. The mainland shoreline, as opposed to the other coastal reaches, is not likely to suffer large-scale storm damage resulting in a **clean slate** redevelopment situation.

The mainland reach differs from the other five coastal reaches in that it is located almost entirely in the **A** flood zone, with a minimum of area designated as **V** zone. Each of the other five coastal reaches has large areas classified as **V** zone, which will subject them to the greater destructive forces of storm-driven waves. Structures in the **V** zone are often completely destroyed in a hurricane. **A** zone structures, on the other hand, are subject to static flooding, but not wave action. These structures, therefore, will face water damage from flood waters, but not significant structural damage. The presence of offshore barrier islands and wide, shallow south shore bays provides protection for the mainland shoreline.

Site specific hazard mitigation planning for post-hurricane redevelopment on the mainland shoreline is neither practical nor applicable. Most of this reach is already extensively developed; some vacant land in Suffolk County remains. The problems faced by all communities on the mainland shoreline are similar and are dealt with in a generic manner.

The need for widescale redevelopment along the mainland in the event of a severe storm is very unlikely. Instead, mitigation efforts should focus on measures that could be implemented in day-to-day development decisions. Any hurricane damage mitigation strategy for the mainland should address the small-scale changes that will occur gradually over the long-term, instead of the complete redevelopment option applicable to the barrier islands.

The primary objective for the mainland shoreline is to steer future development or post-storm redevelopment in flood hazard zones to inland sites where structures may be clustered, leaving the waterfront as open space. This strategy can only be effective in those areas with vacant developable land. Such a shift in development would also have the additional benefit of maintaining open space along the waterfront.

A more likely strategy for the mainland shoreline involves the response to repeated flooding of structures in densely developed communities. For these areas, damage mitigation strategies must address options other than relocation. For example, most houses built in the mainland **A** zone were built at grade or below, and are neither floodproofed nor elevated. Many of these houses have experienced repeated flooding. It may be practical and cost-effective to raise these structures above the base flood elevation and place them on piles. FEMA should examine the long-term benefits of such a one-time expense as a payment or as a loan, contrasted against repeated flood insurance claims. The community of Island Park is an example of a location where this strategy may prove effective.

Raising a house is feasible for those structures which were constructed on level slabs. Unfortunately, many houses in the mainland **A** zone were built with basements, which are frequently flooded. In this case, the suggested strategy is for FEMA and the NYS Dept. of State (NYSDOS), through the Uniform Fire Prevention and Building Code, to institute standards for the floodproofing of existing basements and to deny requests for basement construction in flood hazard zones.

A suggested strategy for local municipalities is one which has already been initiated in several communities. Many of the streets and roadways built along the canals and creeks of the

Figure 3-43
Long Beach–
Residential development fronting on canals typifies much of the south shore of Nassau and western Suffolk Counties

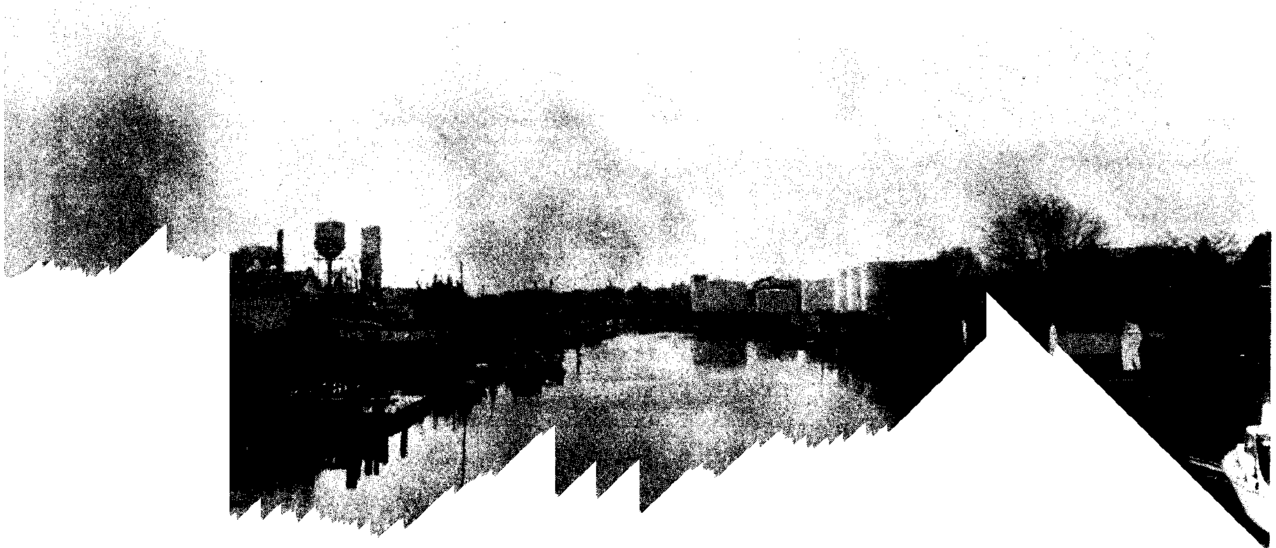


Figure 3-44
Island Park–
Low lying housing fronting on a canal. Note oil storage tanks in background

mainland reach were originally built below the base flood level, and are not only subject to flooding, but act as conduits for flood waters. Communities such as the Villages of Island Park and Lindenhurst have used Community Development Block Grant funds for street raising programs. Implementation of this strategy by municipalities throughout the study area would be highly desirable.

A potentially serious problem for mainland communities is the presence of hazardous material storage sites (such as oil terminals), sewage treatment plants, landfills and incinerators within flood hazard zones. Damage to hazardous material storage facilities located within the 100-year floodplain may result in the release of this material into the coastal environment, thus posing potential threats to public health and coastal ecosystems. It is, therefore, imperative that if these structures are to remain or be constructed within the 100-year floodplain that they be adequately floodproofed.

3.7.2 Mastic Beach Detailed Study Area

3.7.2.1 General Description and Problem Statement. The Mastic Beach detailed study area is located on the south shore of Brookhaven Town, east of William Floyd Parkway. It is flanked on two sides by public open space. Study area boundaries are depicted in Fig. 3-45.

Three principal land uses can be found in this study area: medium density residential, commercial recreation, and vacant. The vacant category comprises approximately 50% of the detailed study area. A significant portion of the vacant category contains either maritime flora or tidal wetlands. The entire area is zoned for single-family residences with minimum lot sizes of 15,000 sq ft. It is important to note that an old-filed subdivision with a grid street pattern covers much of the vacant area. The shoreline along much of Narrow Bay has not yet been bulkheaded.

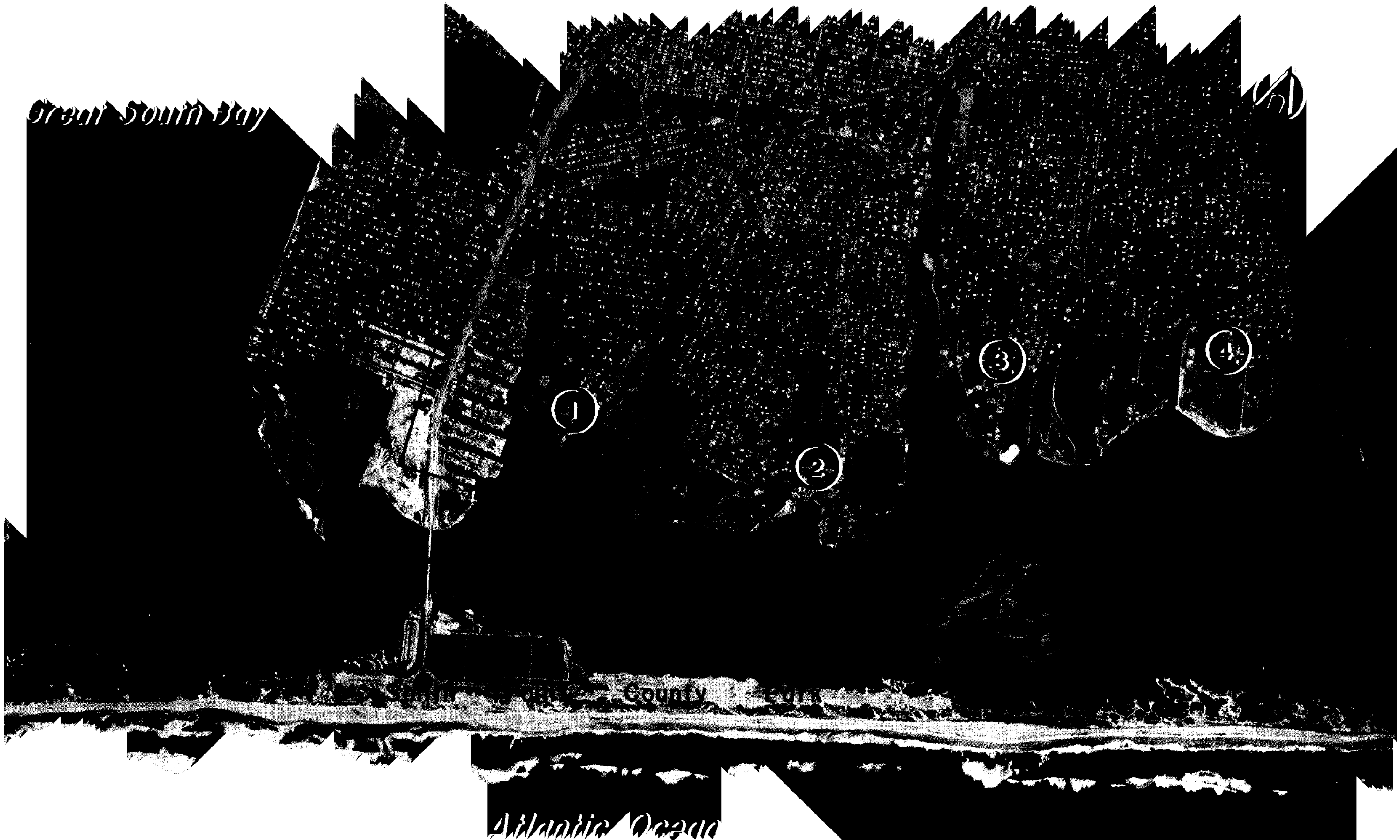
All of the land in the study area is within the **A** zone. There is a small seasonal population in Mastic Beach, but the majority of homes are used as primary residences. The value of all residential structures in the Mastic Beach study area totals $6.6 million (based on 1980 Census data).

The area was chosen for detailed study because it typifies flooding problems found on the bay shoreline in which low-lying, older residential areas are periodically inundated by tidal flooding, resulting in persistent and significant flood-related damage. It was also chosen because there are structures located within or adjacent to tidal wetlands that, if destroyed, may present an opportunity to protect wetlands, while at the same time reducing potential flood losses. (See Figs. 3-46 and 3-47.) It is anticipated that as shorefront property becomes scarce on eastern Long Island, pressure to develop the vacant shorefront areas in Mastic Beach will increase. Thus, this area presents an opportunity to prepare a development plan that recognizes the need for sound floodplain management.

3.7.2.2 Mastic Beach Strategies

- The scattered residences in the flood zone should be removed and relocated to inland locations. Suitable upland parcels owned by the Town of Brookhaven or Suffolk County should be identified and designated as appropriate sites for relocation.
- The relocation of structures from this study area would help to provide a buffer zone between the upland development and adjacent wetlands and bay environments. The establishment of a buffer zone would also add to the protection of the more densely developed areas in the event of a major storm. This strategy is in accordance with the State purchase of wetlands in the western portion of the study area.
- There is a high potential for future development of the low-lying flood-prone areas of Mastic Beach, due in part to its proximity to FINS and the Suffolk County Park at Smith Point. Therefore, there is a need to act swiftly to protect and rehabilitate the extensive wetlands in the study area.
- The Town of Brookhaven should rezone to a lower density those areas within the study area subject to old-filed subdivision maps in order to limit the density of future development should a large number of parcels be assembled by a single owner.
- Use of public funds to upgrade roads and provide municipal water supply should be discouraged in the detailed study area.

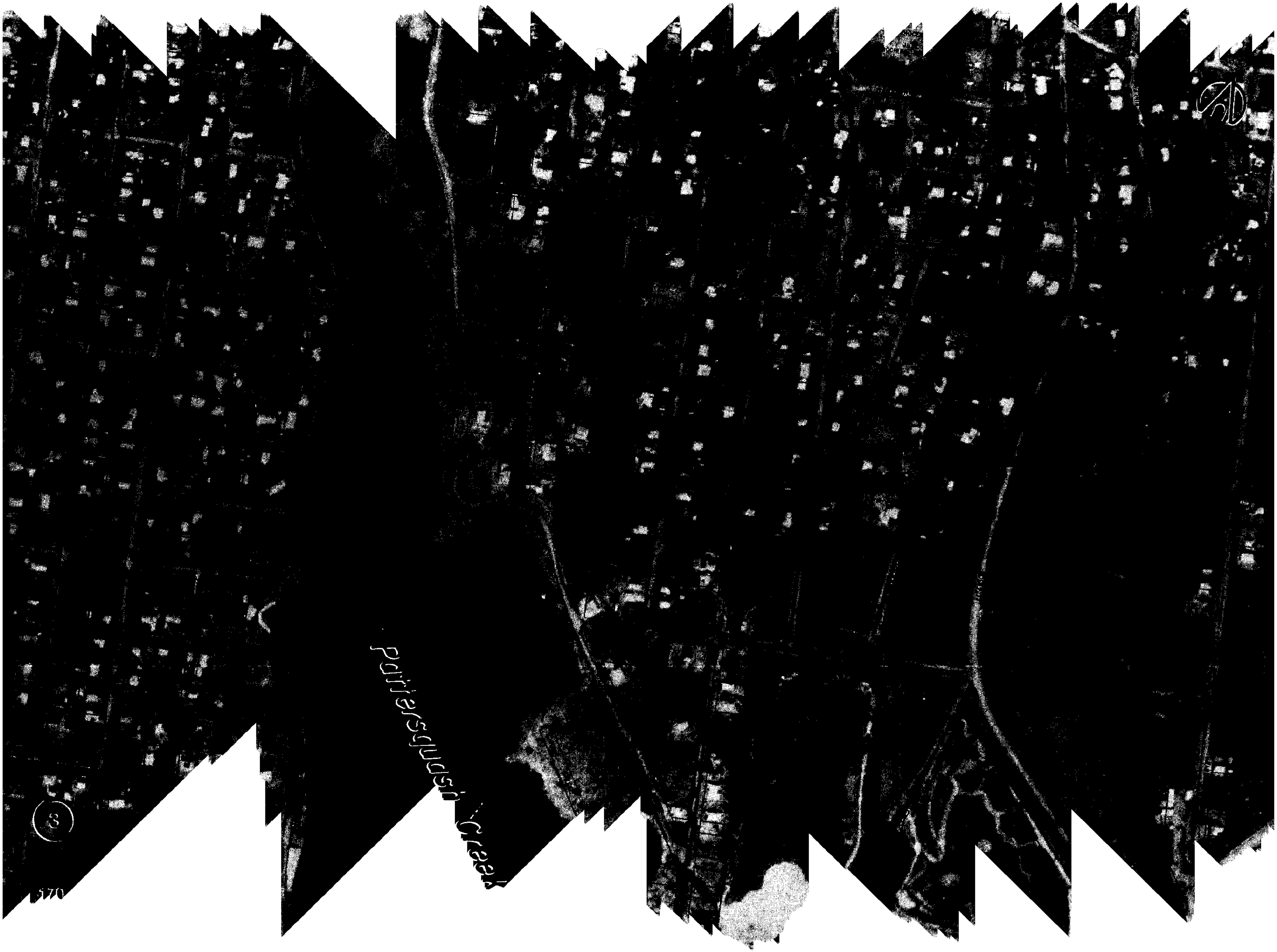
Designated tidal wetlands encompass approximately 50% of the detailed study area depicted in Fig. 3-45. New York State has purchased tidal wetlands adjacent to and surrounding Johns



KEY AERIAL
— Study Area
MASTIC BEACH

Johns Neck Creek
Moriches Bay
168


2
Moriches Bay


Pattersquash Creek
8
170

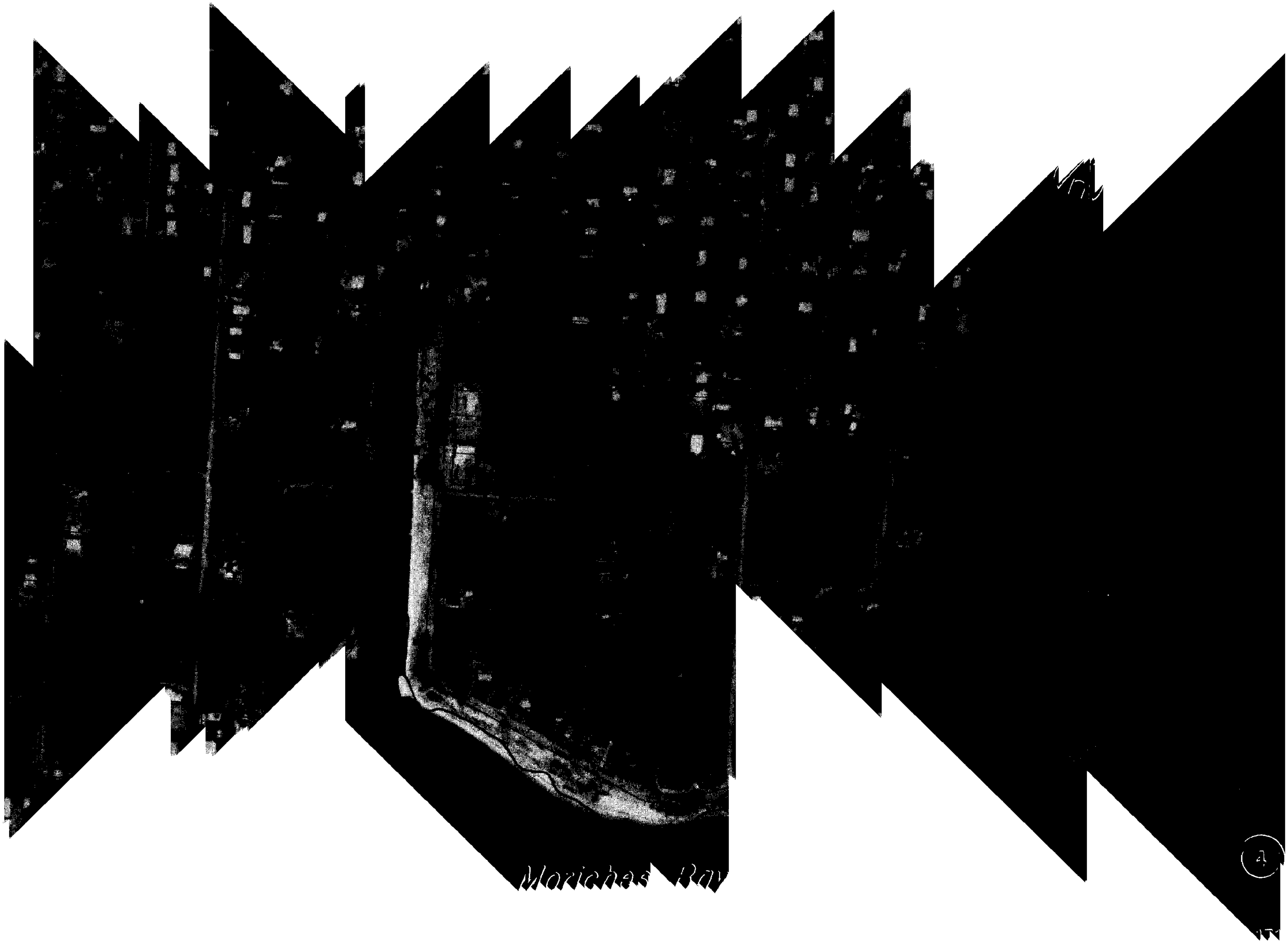
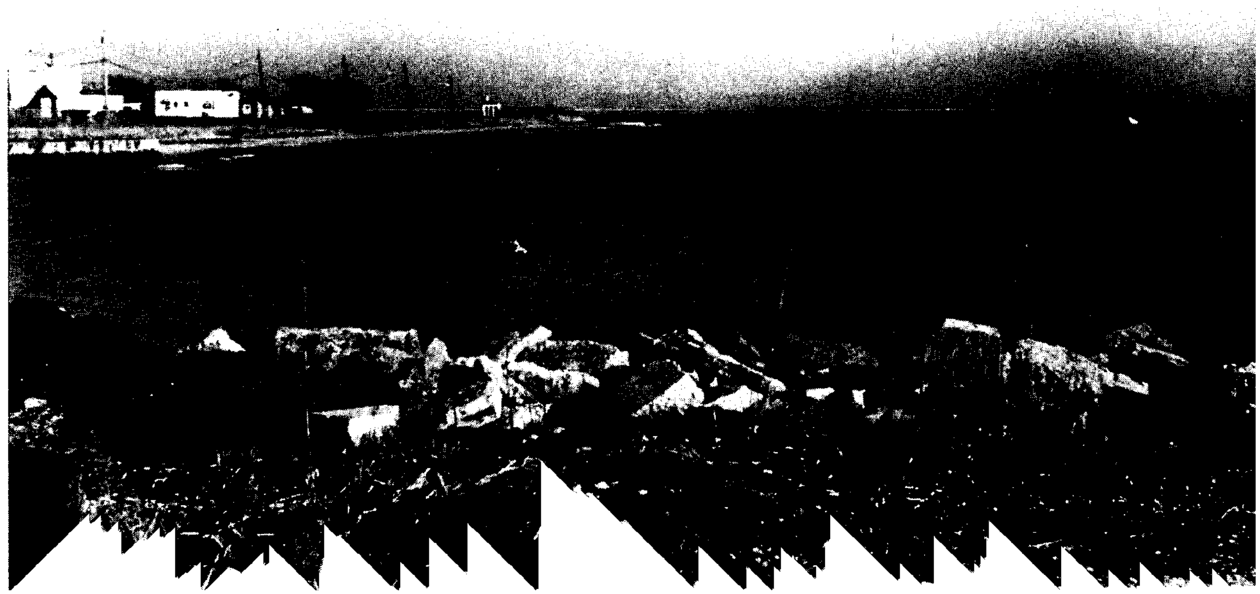

Moriches Bay
4

Figure 3-46
Mastic Beach–

Views of shoreline showing extensive wetlands and scattered residential development

Figure 3-47
Mastic Beach



Neck Creek. Based upon an analysis conducted in 1983 for the COE reformulation study on the project entitled *Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project*, it was determined that there are 59 homes situated within 100 ft of tidal wetlands valued at approximately $2,100,000 (URS Company, Inc., 1982). These homes range in elevation from 1.5 to 3.4 ft above msl. The base flood elevation identified on the FIRMs for the 100-year floodplain is 8 ft msl. Thus, should the area experience a 100-year flood, one could anticipate that these homes would be inundated with 4.5 to 6.5 ft of water, resulting in the probable destruction of these homes.

A review of census data indicates that 25% of the homes within the census tract are used on a seasonal basis. If one applies this percentage to the 59 homes adjacent to tidal wetlands, 15 of these homes would be used seasonally. Therefore, there would be 44 primary residences adjacent to tidal wetlands which would be subject to significant flooding effects.

Should this occur, FEMA should pay the full value of the flood insurance policies on a one-time basis. Suffolk County, in cooperation with the Town of Brookhaven, should then seek to relocate these individuals to County-owned land outside of the 100-year floodplain. Redevelopment efforts should focus on parcels within the Mastic Beach area which have been acquired through tax liens. This could be accomplished through a swap or trade of land between the owner(s) and the County. Should the tax lien parcel include a house, the owner being relocated could pay the County the fair market value of the house, or the value of the flood insurance claim, whichever is less. The parcels adjacent to tidal wetlands would then be owned by the County. This land should be kept as open space.

There are a total of 222 homes located within the detailed study area, of which it is estimated that 25%, or 55, are used seasonally. If one subtracts the 59 homes adjacent to tidal wetlands from the total within the detailed study area, 163 homes remain within the detailed study area on land having an elevation ranging from 3.5 to 5 ft msl. These homes would experience 3 to 4.5 ft of flooding in the event of a 100-year storm, and probably would not be completely destroyed. In these instances, it is recommended that the Federal government issue a grant or low interest loan to the homeowner for the purpose of raising the structures to or above the base flood elevation to avoid future public expenditures for flood-related damages and disaster assistance. Thus, this plan recognizes that residential use will continue in the detailed study area.

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Chapter 4....

Suggested Modifications to Selected Government Programs

4.0 INTRODUCTION

There are a myriad number of federal and state regulatory programs which affect development and post-storm redevelopment along Long Island's south shore floodplain. Many of the strategies and recommendations contained in this report cannot be implemented independently—successful application of these strategies will require a number of changes in several of the regulatory programs.

This chapter presents an analysis and recommendations for changing the following three programs:

- National Flood Insurance Program
- Coastal Barrier Resources Act
- New York State Coastal Erosion Hazard Areas Act

These three programs were chosen for detailed examination because they were found to most critically affect both current coastal development and post-storm redevelopment.

In addition, this chapter includes an analysis of hurricane evacuation problems on the south shore of Long Island, based upon a series of interviews with county and local officials responsible for emergency action. Federal and state programs which are geared to emergency assistance and recovery are not addressed here; they are reviewed in Chapter 5.

4.1 THE NATIONAL FLOOD INSURANCE PROGRAM

Federally subsidized flood insurance has been available in the United States since 1968 when Congress passed and the President signed into law Title XIII of the Housing and Urban Development Act of 1968 (P.L. 90-448). It provided previously unavailable flood insurance protection to owners of structures in flood-prone areas. At that time, participation in the NFIP was voluntary. The Federal government offered low-cost flood insurance to individuals in those communities that adopted and enforced certain minimum floodplain management regulations.

The Act was amended in 1973 by the Flood Disaster Protection Act (P.L. 93-234). The 1973 act required:

- designated communities to participate in the flood insurance program or face restrictions of federal financial assistance
- property owners to purchase flood insurance to receive new or additional federal or federally related financial assistance for acquisition or construction purposes in identified special flood hazard areas.

To obtain federal disaster assistance for construction or reconstruction purposes, this Act also required property owners in participating communities to first purchase flood insurance. The Housing and Community Development Act of 1977 removed the prohibition against conventional mortgage loans from federally regulated lenders in flood-prone communities not participating in the program, and added a notification procedure to alert prospective mortgagees that flood disaster relief would not be available for properties in those communities.

The maximum insurance coverage presently available depends on whether a community is in the emergency or regular program. A community initially enters the **emergency** program by adopting minimum floodplain management regulations to guide new construction in flood-prone areas. The community enters the **regular** program after a detailed FIRM is completed by FEMA, and local officials enact regulations that require all new or substantially improved structures to be built in accordance with federal floodplain management criteria. The maximum amounts of insurance are as follows:

Maximum Insurance Available

Program and building type	Building	Contents
Emergency Program:		
Single family residence	$ 35,000	$ 10,000
Other residential	100,000	10,000
Non-residential	100,000	100,000
Regular Program:		
Single family residence	185,000	60,000
Other residential	250,000	60,000
Small business	250,000	300,000
Other non-residential	200,000	200,000

It is noted that all municipalities with a marine floodplain in Nassau and Suffolk Counties currently participate in the regular program.

The minimum standards for community floodplain management regulations include, but are not necessarily limited to:

- A permit procedure to assure that buildings are adequately anchored and constructed with materials utilizing methods that will minimize flood damage.
- Water and sewer design requirements which will limit infiltration of flood waters.
- A requirement that the lowest habitable floor (including basements) of all new residential construction and substantial improvements be elevated above the base flood level. Basement exceptions can be granted based upon a show of **severe economic hardship** and **gross inequity** in a particular community.
- A requirement that an architect or engineer certify that the floodproofing methods are adequate to withstand the forces of flooding and that the structure has been floodproofed to the proper elevation.
- A requirement that all new construction within the **V** zone must be located landward of the reach of mean high tide, and that the use of fill to elevate structures within such zone is prohibited.
- A requirement that new construction within the **V** Zone has the space below the lowest floor free of obstructions or constructed with **breakaway walls.** Such space is not to be used for human habitation.

Variances to floodplain management regulations can be issued by the community. Should the issuance of variances indicate a pattern inconsistent with the objectives of sound floodplain management, the community could face suspension from the NFIP.

There are other sections of the law that are intended to have the effect of reducing storm-related damage. Section 1362 authorizes the purchase of structures and property when the structures have been damaged:

- substantially beyond repair
- not less than three previous times during the preceding five-year period, each time the cost of repair equalling 25% or more of the structure's value
- from a single casualty of any nature so that a statute, ordinance or regulation precludes its repair or restoration or permits repair or restoration only at significantly increased cost.

Section 1362 is intended to minimize recurring storm related damage. Funding for Section 1362 nationwide amounts to $5 million per year in fiscal years 1984 and 1985. These funds have already been obligated.

Section 1316 permits a state or community to declare individual structures in violation of required floodplain management regulations. The community can then petition FEMA to terminate the flood insurance. A threat of flood insurance revocation would in theory force compliance with floodplain management regulations. This section of the law, however, has never been used.

FEMA is responsible for managing the NFIP. It is responsible for the conduct of the mapping program, establishment of floodplain management criteria and ensuring that participating communities adopt and enforce ordinances and floodplain management regulations. The Federal Insurance Administration within FEMA manages the insurance aspects of the program.

4.1.1 Hurricane Damage Mitigation and the NFIP

A central question to the issue of hurricane damage mitigation is the extent to which the program contributes to the reduction of storm related damages. The program was designed to serve two principal objectives: to provide a federally subsidized insurance (up to 90%) for existing floodplain uses as an incentive to state and local government for them to adopt regulations guiding new development away from the floodplain; and to provide a mechanism whereby floodplain occupants eventually would help pay for flood losses (Kusler, 1982).

A review of the floodplain management criteria found in 44 CFR Part 60, Section 60.3 indicates that the regulations do little to guide new development away from the floodplain. Structures must be adequately raised and anchored; basements and use of fill (in the **V** zone) are prohibited. The regulations prohibit manmade alteration of sand dunes within the **V** zones. However, the NFIP does not provide for the mapping of dunes, nor are dunes within the **A** zone similarly protected. Section 1362 of the Act could be used to remove development in the floodplain subject to recurring damage; however, it is drastically under-funded. Thus, if properly enforced, the floodplain management criteria probably do provide some protection from flooding (for new structures). They do not guide new development away from the floodplain, nor do they encourage the removal of existing structures out of coastal high hazard areas.

As noted earlier, communities may issue variances to the floodplain management criteria. The issuance of such variances generally is limited to a lot size less than one-half acre; as the lot size increases beyond one-half acre, the technical justification required for issuing a variance becomes more demanding. Thus, the issuance of variances is facilitated in flood-prone areas, such as the Long Island south shore barrier islands (especially Fire Island), since lot sizes in most cases are smaller than one-half acre.

The basement exception is a form of variance that has been sanctioned by FEMA and is under active consideration for the Town of Hempstead. A basement exception has recently been granted to the Town of Southold. Under current regulations, a local government cannot permit the construction of basements in an **A** zone. The Town of Hempstead has petitioned FEMA for an exception to this requirement so that it can allow the construction of basements in the 100-year floodplain and its residents can receive appropriate flood insurance coverage. The potential for increased flood losses which will probably result could be significant. *FEMA should examine flood insurance claims in Southold and other areas with basement exceptions to determine the extent of flood-related basement damages. If this figure is significant, FEMA should eliminate the current basement exceptions and not grant any new exceptions.*

Communities in the regular phase of the NFIP and with identified coastal high hazard (**V** zone) areas must ensure that construction is located landward of mean high water. However, under NFIP standards, structures may be built in wave velocity zones and erosion areas if protection is provided to the 100-year flood elevation and a registered architect or professional engineer certifies that the structure is properly secured to adequately anchored pilings or columns in order to withstand velocity waters and hurricane wave wash. Thus, structures once located on the beach that have been destroyed by storm-induced flooding, such as at Westhampton Beach, could be rebuilt on pilings and remain eligible for flood insurance, so long as other regulations are met, thereby establishing a cycle of repeated flood losses.

Merely elevating the structures on piles in a **V** zone is insufficient. A review of the calculations of expected damage made prior to 1981 by FEMA showed that the first increment of damage to a building with no basement was assumed to occur when water reached the lowest floor. However, when the building is located in a **V** zone environment, insurance claim files document that considerable flood damage begins to occur when flood waters and wave action first reach the building site, prior to any water actually entering the building (Reilly, 1983). *The Federal government should modify the NFIP to phase out flood insurance in* **V** *zones. Flood insurance should not be made available to new development in* **V** *zones. Current policy holders whose structures are damaged greater than 50% of structural value should receive a final payment equal to the full value of their structure, up to the policy limit, if the homeowner agrees not to rebuild in the* **V** *zone. If the homeowner wishes to rebuild in the* **V** *zone, flood insurance payments would reflect the actual structural damage only, up to the policy limit; and further, flood insurance coverage would not be available for that structure.*

FIRMs for Long Island communities have been adjusted to take into consideration the potential wave impacts. There are, however, still some potentially significant mapping errors. The most conspicuous are the maps depicting the Long Beach barrier island. The City of Long Beach is shown as having a significant portion of its land area outside the 100-year floodplain, i.e., above the base flood elevation of 12 ft msl. Examination of topographic data and sewer maps indicates that much of the City is below 10 ft msl. Thus, some of the City's residents may not have flood insurance and yet are exposed to potentially serious flooding. *FEMA should amend the FIRMs as required.* (See Sec. 3-2.)

FIRMs are suitable for insurance purposes, but not for land use management. Scales are often too small to make a determination whether a proposed development is within or outside of the 100-year floodplain. Topographic information, existing land use and other data are lacking. *FEMA should delineate the boundaries of the flood zones with greater precision on the FIRMs.* This may require FIRMs at a larger scale.

The NFIP does not encourage the owner of a structure in the **V** zone to relocate. Payment is only made for the replacement cost of the damaged structure. Should an individual desire to relocate, or should the locality want the structure rebuilt on another parcel outside the hazard zone, the individual will not be compensated for the property, i.e., the land and undamaged portion of the structure. It is up to the individual to take the loss, or the locality to condemn and purchase the property should the individual not desire to sell. In this sense, the NFIP does not encourage relocation outside the flood hazard zone. *It is recommended that the Federal government, through FEMA, re-institute the constructive total loss program, whereby a claimant is paid the total insured value of the structure and, in return, the claimant donates the property to the locality. Monies for this program should come from increased NFIP premiums. In addition, Congress should significantly increase appropriations for section 1362.*

The NFIP floodplain management criteria do not address re-development in a post-storm situation. There may be areas, such as **V** zones or barrier islands, where re-development in the same location would be imprudent and would result in a continuing cycle of flood losses. *It is recommended that the floodplain management criteria be amended to require communities to enact a building moratorium in instances of large scale storm damage.* This will provide all levels of government time in which to assess the problem and formulate and implement land use alternatives that will mitigate future storm damage.

The floodplain management criteria also do not address the types of land uses permitted on municipally owned property. The common assumption is that oceanfront or barrier beach property owned by the locality will be used for recreation purposes. This is not the case in certain instances on Long Island where residential structures are built on town owned land in the **V** and **A** zones. Sound floodplain management practices should be required of localities. *FEMA, through its floodplain management criteria, should require that municipally owned property be kept in or revert to recreation, open space or water dependent uses.* FEMA, however, has steadfastly refused to influence local land use policies. Over a 15 year period, only three communities nationwide have been disqualified from the NFIP despite other repeated, documented violations of floodplain management criteria (U.S. General Accounting Office, 1982). FEMA should use the *Community Assistance and Program Evaluation* (CAPE) procedure to closely monitor the performance of local floodplain management efforts.

Finally, *FEMA, in cooperation with the National Weather Service, should expand the tidal gauge network on Long Island, to acquire more flood elevation data and improve forecast and warning capabilities.* During the northeast storm event of 29 March 1984, the two existing tidal gauges for Long Island were insufficient in providing the lead time necessary to take emergency response measures (FEMA, 1984).

4.2 COASTAL BARRIER RESOURCES ACT

On 18 October 1982, President Reagan signed the Coastal Barrier Resources Act (CBRA) into law (P.L. 97-348). The new law establishes the Coastal Barrier Resources System as referenced and adopted by Congress, and prohibits Federal expenditures and financial assistance (grants, loans, loan guarantees, and insurance) for development of coastal barriers, or portions thereof which are not presently developed. These provisions of the Act, with the exception of the prohibition of new Federal flood insurance coverage in designated coastal barrier resource units, became effective immediately. The statutory ban on Federal flood insurance went into effect on 1 October 1983.

The legislation does not give the Federal government any new acquisition authority, nor does it offer any appropriations for acquisition purposes. Furthermore, the Act does not prohibit issuance of Federal permits for dredging projects, sewage disposal, etc., nor does it preempt local government zoning and permitting authorities. The Act simply advances the philosophy that the risk associated with new private development in these hazardous areas should be borne by the private sector and not underwritten by the Federal government.

Section 4 of the Act establishes the Coastal Barrier Resources System which is shown by a set of maps dated 28 April 1982. The addition of new units to the System or the deletion of existing units within the System as approved by the Congress can only be authorized by an act of Congress. Minor changes to coastal barrier units, however, are permitted under section 4(c).

The term **coastal barrier** is defined as:

> a depositional geologic feature which consists of unconsolidated sedimentary materials subject to wave, tidal, and wind energies and which protects landward aquatic habitats from direct wave attack.

Associated aquatic habitats, including adjacent wetlands, marshes, estuaries, inlets, and near shore waters are also included in the definition of a coastal barrier.

To be included within the System, a coastal barrier must be undeveloped. A coastal barrier is considered undeveloped only if there were few, if any, man-made structures on the barrier and these structures and man's activities on the barrier do not significantly impede geomorphic and ecological processes. The Federal government based its coastal barrier unit designations upon the level of development on the ground as of 15 March 1982. A threshold of approximately one structure per five acres of **fastland** was used in determining if a coastal barrier was developed. The **fastland** portion of coastal barriers is that portion of a coastal barrier between the mean high tide line on the ocean side and the upper limit of tidal wetland vegetation (or, if such vegetation is not present, the mean high tide line) at the rear of the coastal barrier.

Areas established under Federal, state, or local law or held by a qualified organization (as defined in paragraph (3) of section 170(h) of the Internal Revenue Code of 1954), primarily for wildlife refuge, sanctuary, or natural resource conservation purposes were not included within the Coastal Barrier Resources System. A qualified organization must have had the intent, as well as the capability, to maintain the natural character of a coastal barrier ecosystem. The organization must have also had a real property interest to provide for its protection and maintenance.

In summary, to be eligible for consideration as a designated coastal barrier unit, an area must be a **coastal barrier**, it must be **undeveloped**, and it must not be **otherwise protected.**

New Federal expenditures and financial assistance for development of designated coastal barrier units are prohibited for any purpose including, for example, the construction of roads and bridges, sewers, or federally guaranteed loans, such as Veterans Administration or Federal Housing Administration loans for home construction. Federal assistance for stabilization projects is also prohibited, except in cases where an emergency threatens life, land and property immediately adjacent to a coastal barrier unit.

The Act does not prohibit banks, savings and loans or other commercial financial institutions (including those insured by the

Federal government) from making loans for homes or other forms of construction within the coastal barrier units. This legislation does not prohibit private financial transactions or the construction of structures or facilities that are funded with private funds or funds provided by state and local governments.

Although the Act prohibits the expenditure of Federal funds on designated undeveloped coastal barriers, certain exceptions to the prohibition are permitted and are listed below:

- exploration and extraction of energy resources, which can only be carried out within the System
- maintenance of existing channel improvements and related structures, such as jetties, including the disposal of dredged materials related to such improvements
- military activities essential to national security
- establishment, operation, and maintenance of air and water navigation aids and devices
- projects under the Land and Water Conservation Fund
- projects which provide for the study, management, protection and enhancement of fish and wildlife resources and habitats. Such projects may include acquisition of habitat or structural stabilization to protect these habitats, and recreational projects
- scientific research
- assistance for emergency actions essential to saving lives or protection of property within the coastal barrier units. Such actions shall be limited to the extent necessary to alleviate the emergency and not be used as a justification for any projects that exceed the scope and needs of the true and immediate emergency
- funds for the maintenance, replacement, reconstruction, or repair, but not the expansion, of publicly owned or publicly operated roads, structures, or facilities
- nonstructural projects, such as the planting of dune grass or beach nourishment which mimic, enhance, or restore natural stabilization systems, would be permitted for shoreline stabilization

The following 12 Long Island coastal barrier units, which contain approximately 20 miles of shoreline and over 5000 acres of land, are included within the Coastal Barrier Resources System:

Fishers Island Barriers Unit	Acabonack Harbor Unit
Eatons Neck Unit	Gardiners Island Barriers Unit
Crane Neck Unit	Napeague Unit
Old Field Beach Unit	Southampton Unit
Shelter Island Barriers Unit	Tiana Beach Unit
Sammys Beach Unit	Mecox Unit

4.2.1 Suggested Modifications to CBRA

CBRA and section 341(d) of the *Omnibus Budget Reconciliation Act* (OBRA) of 1981 (P.L. 97-35), which prohibited the issuance of new Federal flood insurance on designated undeveloped coastal barriers and was subsequently superceded by CBRA, provide that an undeveloped coastal barrier shall not be designated if it is **otherwise protected.** The term **otherwise protected** is a protected status referring to coastal barriers which are included within the boundaries of an area established under Federal, state or local law or held by qualified not-for-profit organizations. In both instances, the area must be held primarily for wildlife refuge, sanctuary, recreational, or natural resource conservation purposes.

A U.S. Dept. of the Interior (undated) report to Congress recommended that the provision in the OBRA providing for the exclusion of undeveloped coastal barriers having protected status be eliminated, and that protected areas in governmental and private ownership be included within the scope of OBRA. The report gives the following two reasons why protected areas should be included within the scope of the OBRA:

> First, not all of the areas which are excluded under the terms of this provision are actually protected. Determining with certainty that protection is actual and permanent is extremely difficult and requires the detailed examination of the terms of such statutory authorization or deed. More significant, however, is the difficulty in cataloging privately owned properties within the boundaries of governmental conservation areas. Because these inholding areas are privately owned, they are generally subject to development, even though within the boundaries of a conservation area.
>
> Our second concern is whether there is any reasonable purpose in excluding **otherwise protected** areas from designation. From our perspective, this aspect of the Reconciliation Act does not appear to be consistent with the overall intent of Congress. To the degree such areas are truly **otherwise protected** and not subject to

development, Federal flood insurance seems not to be necessary or appropriate. The sale of Federal flood insurance for development within governmental areas set aside for conservation purposes seems particularly inappropriate. Not only is this inconsistent with the protection of the conservation area, but it is also inconsistent with the treatment of similar lands outside of the boundaries of the **protected governmental unit**.

The Dept. of the Interior is compiling a list of all coastal barriers in public or private ownership that are treated as **otherwise protected** for consideration by Congress for inclusion within CBRA. *The Federal government should include the* **otherwise protected** *areas within CBRA and, thereby, eliminate Federal expenditures and financial assistance for development of privately owned properties that are not* **otherwise protected,** *but yet within the boundaries of governmental conservation areas.*

4.3 NEW YORK STATE COASTAL EROSION HAZARD AREAS ACT

New York State's *Coastal Management Program* (CMP) received Federal approval in September 1982. In order to meet the requirements of the Coastal Zone Management Act of 1972 (P.L. 92-583), the State had to enact legislation addressing coastal erosion problems. Thus, in 1981 the State Legislature passed the *Coastal Erosion Hazard Areas Act,* (Article 34 of the ECL) as the principal law governing erosion and flood control along New York's coastline. The accompanying regulations and area maps are now in the final stages of approval (Coastal Erosion Management Regulations, 6 NYCRR 505).

The purpose of Article 34 is to minimize or prevent damage and destruction to property and natural resources from flooding and erosion due to inappropriate actions of man. This coastal hazard mitigation policy is to be carried out through a regulatory program based on the control, through permits, of development and other land use activities in designated erosion hazard areas. Article 34 is intended to be implemented at the local level, except for State agency activities, which will require permits directly from the NYSDEC. Localities must adopt State-approved coastal erosion ordinances incorporating the standards outlined in the regulations.

Local implementation is not required until after the NYSDEC has filed coastal erosion hazard area maps with a city, town, or village. Local governments then have the option to submit a program to the NYSDEC for approval within six months; however, should a town refuse or fail to adopt a satisfactory program which meets the standards and administrative and enforcement requirements, regulatory authority will revert to the county and then to the State.

The NYSDEC is now in the process of reviewing the erosion hazard area maps that have been prepared for the south shore coastal areas. Erosion hazard areas are defined in the regulations as **natural protective feature areas** or **structural hazard areas.** Most of the south shore falls into the first category, where natural protective features were used to determine the landward boundary of the hazard area. This boundary or setback line is defined in the regulations as being set back 25 ft from the landward edge of the dominant natural protective feature. Three types of natural protective features were used in delineating the boundary:

- the highest, most continuous dune formations
- bluffs, where existent
- the landward edge of the beach in areas with no dunes or bluffs

This line was surveyed independent of political divisions, erosion rates (too variable in these areas) or existing structures. Structural hazard areas have been designated along bluff shorelines with known annual recession rates of 1 ft or more (e.g., the eastern portion of East Hampton). The depth of the zone is defined as 40 times the average annual recession rate plus 25 ft. The sole acceptable basis for an appeal of a hazard area designation by a property owner is through submission of technical information showing that the long-term average annual rate of shoreline recession was incorrectly established, or that the area was mistakenly identified as a natural protective feature area.

Erosion area permits must be obtained for development, new construction, erosion protection structures, public investment, and other land use activities within the designated coastal hazard areas. Permit applications are to include a description of the proposed activity, a map, any additional information, and a fee. Approval is contingent upon compliance with the standards, restrictions and requirements; however, conditions can be attached to the permit, if deemed necessary. The proposed regulated activity must meet the following general standards:

- it must be reasonable and necessary, relative to alternative sites and the necessity for a shoreline location
- it must not aggravate erosion
- it must prevent or minimize adverse effects on natural protective features, erosion protection structures or natural resources.

Furthermore, the regulations delineate restrictions on specific land use activities within both types of coastal hazard areas. For natural protective feature areas (Section 505.8), specific restrictions are delineated for activities in nearshore areas, beaches, bluffs, and primary and secondary dunes. Regulated activities include:

- dredging, excavating and mining
- construction, modification or restoration of docks, piers, wharves, groins, jetties, seawalls, bulkheads, breakwaters and revetments
- beach nourishment
- vehicular traffic
- the creation of pedestrian passages.

Activities not requiring a permit include planting, sand fencing, and the erection of private elevated stairways. Within structural hazard areas (Section 505.7), the construction of non-moveable structures is prohibited; the construction of moveable structures is allowed, but only if the structures are set back 50 ft from the edge of the bluff, with no permanent foundations, and if a relocation plan is included with the permit application. The installation of public service utilities requires a permit. Grading and excavating near bluffs must not direct surface water runoff over the receding edge.

A permit is required for the construction, modification, or restoration of erosion protection structures, with the following conditions: proper design, minimum 30 year life, long-term maintenance program, and the use of appropriate materials. The structures cannot aggravate erosion at the site or adjacent sites and must minimize/prevent adverse effects to natural protective features (Section 505.9).

Any permit applicants wishing to obtain a variance must prove that compliance with the restrictions would cause unnecessary hardship or result in practical difficulties. They also must show that no reasonable alternative site exists, that responsible means and measures have been incorporated into the project design at the developer's expense, and that the structure(s) will be reasonably safe from flood and erosion damage (Section 505.13). A bond may be required from applicants with a record of non-compliance (Section 505.12). Whenever emergency activities are undertaken, damage to natural protective features and other natural resources must be prevented or minimized, and the NYSDEC must be notified according to set procedures (Section 505.11).

4.3.1 Conflicts between the Coastal Erosion Hazard Areas Act and the NFIP

The management regulations promulgated by the NYSDEC for the Coastal Erosion Hazard Areas Act contain several areas of potential conflict with the NFIP as currently administered by FEMA. Article 34 was created to minimize damage and destruction to property and natural resources from flooding and erosion by prohibiting most development, construction, or excavation within erosion hazard areas as defined by a coastal construction setback line. This line, or boundary, is to be drawn relative to **natural protective features,** such as dunes; or in relation to **structural hazard areas,** such as bluff shorelines. This approach differs from the 100-year floodplain designations of the NFIP, which are based on hydrologic models. The south shore floodplain will encompass some erosion hazard areas; the structural hazard area, however, may be located out of the floodplain because of bluff elevation.

If a structure within a designated erosion hazard area was damaged or destroyed by a storm, Article 34 administrators could prohibit rebuilding by denying a permit. If the structure is insured under the NFIP, the only compensation available would be the amount needed to replace the home or its damaged portion, less the deductible, up to the value of the policy. The homeowner could be denied a permit to rebuild his home, rendering the house uninhabitable; yet he will only be eligible to receive the partial value of his property from FEMA, as represented by the damaged portions.

Should this situation arise, Article 34 administrators will be faced with a choice of two undesirable alternatives. The first option would be to stand firm behind the permit denial decision, which may lead to assertions of **taking** and lawsuits by the homeowner seeking to recover the full value of the property. Recent judicial decisions in New York State* in which homeowners challenged local ordinances restricting or denying building/rebuilding in hazard areas have ruled in favor of the homeowners, instructing the local municipalities to either approve the permit application or acquire the property through condemnation proceedings.

The second option available under Article 34 would be to permit the rebuilding of the damaged structure through the issuance of a variance. Such an action could run contrary to the goals of Article 34, which seek to minimize or prevent damage or destruction to man-made property and prevent the exacerbation of erosion hazards. Nevertheless, without sufficient compensation from FEMA and the NFIP, variances may become inevitable.

There are two elements of the NFIP that could provide a solution to the potential conflict outlined above: the constructive total loss approach and the Section 1362 relocation program. The **constructive total loss** approach was designed to cover those cases where a property is not totally destroyed, but has lost its economic value. It would be most applicable where the local government has taken action to prohibit damaged structures from being rebuilt in areas with a high likelihood of future flooding. This would allow FEMA to declare the property a **constructive total loss** and pay the owner's claim up to the policy limits, even though the actual damages do not equal the total covered by the policy. The owner can then use the money to rebuild on a site outside the flood hazard area, and ownership of the damaged property is dedicated to the community for open space use.

Section 1362 of the National Flood Insurance Act empowers FEMA to purchase insured properties that have been seriously damaged by flooding, to move the damaged structures, and to transfer the land as open space to a state or local government agency. The property owner can use the money from the sale to rebuild at another location outside the flood hazard area.

The difference between the constructive total loss program and Section 1362 is that the former may be used at the discretion of the Federal Insurance Administrator and uses funds from the general program revenues, while Section 1362 is applicable only when specific criteria are met, is difficult to qualify for, and uses funds from a special appropriation pool. The funds allocated for Section 1362 are less than $5 million per year and are already committed through fiscal year 1985, allowing for a minimum of activity under this program.

Unfortunately, the constructive total loss program was discontinued by FEMA in 1984, leaving only Section 1362 in place as a means to relocate damaged structures. *The constructive total loss approach, as originally conceived, could have provided an ideal solution to the problems raised by the Coastal Erosion Hazard Areas Act. By providing a single payment, homes would be removed from flood hazard areas, homeowners would be compensated for the full value of their property (up to the policy limit), local government would acquire additional property for park or conservation purposes, and FEMA would benefit in the long run by not having to make repeated payments on a vulnerable property.* Additional benefits would accrue if a protective dune could be created on the property, offering protection to nearby structures. Reinstatement of the constructive total loss program with sufficient funding could contribute to the successful implementation of Article 34.

4.4 HURRICANE EVACUATION PROBLEMS ON THE SOUTH SHORE OF LONG ISLAND

The evacuation of people from the south shore of Long Island in the event of a hurricane could pose serious problems in several instances. The problems arise from the fact that it is difficult to persuade people to leave their homes prior to a storm's actual occurrence. When a storm actually impacts the area and people may be willing to leave, key evacuation routes could be flooded. These problems, and others, are discussed in this section.

A series of interviews with various agency representatives responsible for hurricane evacuation planning on Long Island indicates that official concerns range from fairly modest to crucial. FEMA should consider all of them; however, some deserve more attention than others. These concerns are listed on the following page. It should be emphasized that this grouping does not necessarily agree with the opinions of the officials interviewed.

*Lemp v. Town Board of Town of Islip (90 Misc. 2d 360, 394 N.Y.S. 2d 517, Sup. Ct. 1977)

Seidner v. Town of Islip (84 A.D. 2d 819, 449 N.Y.S. 2d 440, 453 N.Y.S. 2d 636, Sup. Ct. 1982)

1. Some problems will require a significant input of public funds to reach a viable solution. Included in this category would be the raising of roadways above the 100-year base flood elevation. The three roadways accessing Long Beach Island, and Montauk Highway at Napeague in East Hampton, are susceptible to flooding during storms. Since experience shows that many people fail to leave their homes until a storm actually hits, these flooded roads may prevent evacuation in the areas mentioned. It is reasonable to assume that engineering studies of this problem will show that roadway elevation will entail high costs. Potential funding sources for road improvement projects, such as Community Development Block Grants, should be identified. An associated problem at Long Beach is the blocking of the railroad bridge with ballasted cars during storm alerts. If the bridge could be strengthened, it would be usable at all times. A study of the cost of this undertaking, together with a study of the railroad's effectiveness as an evacuation route would be desirable.
2. Another category of problems concerns the shortage of necessary emergency equipment, such as auxiliary generators, radios, shelters for emergency personnel, amphibious vehicles, and firefighting apparatus.
3. The Suffolk County Dept. of Emergency Preparedness (SCDEP) has welcomed the support and assistance provided to local authorities by the State Office of Disaster Preparedness. However, SCDEP believes that a FEMA review of local emergency plans is desirable in order to ensure uniformity and adequacy. Such a review would also identify plans that require updating. Furthermore, SCDEP believes that rehearsals are necessary, and that funds be made available for this purpose.
4. A number of officials emphasized the need for an education program to inform the public of the problems inherent in storm forecasting, and to alert them to the dangers of ignoring evacuation orders. In particular, authorities would like to distribute an educational pamphlet to summer visitors on Fire Island, and to hold periodic public seminars.
5. Regret was expressed in some quarters at the aging of the current body of public-spirited volunteers, whose help is vital during any emergency. FEMA should give thought to methods of public education directed toward recruitment. A common complaint was the extreme tardiness of the Federal government in remitting reimbursements to local authorities for expenses incurred in handling emergencies. Streamlining the procedures would greatly improve morale.
6. Long Island officials are very much aware of the fact that all drinking water is drawn from groundwater. Consequently, they are sensitive to the hazards of flood damage to all buried facilities, namely septic systems, liquified petroleum gas tanks, gas lines and power lines. An engineering review of the current standards for the design and installation of buried facilities is recommended with a view to reducing dangers to public health and safety.
7. Communications are not viewed as a problem in Nassau County, where the Emergency Operations Center also houses the police communications center. However, in Suffolk County, problems do exist. Various agencies, county and local, have their own radio frequencies. Personnel are provided with radios which can receive only their own agency's frequencies, but not others. What is needed is a single command frequency which is accessible to all key personnel. FEMA should institute a study of the feasibility of establishing such a command frequency, and determine the quantity and cost of new equipment needed to make it operational.
8. The Town of Islip and authorities responsible for Fire Island believe that evacuation procedures are hampered by the reluctance of some people to pay fares when they have been ordered to leave their homes or vacation accommodations. Such people believe that if the government tells them to move, the government should pay the ferry fare or bus fare. Thus, to avoid delay at the ferry terminal, it is recommended that the town enter into a pre-negotiated lump-sum contract to obtain emergency ferry service when evacuation becomes neces-

sary. It was further considered desirable that these contracts include a clause stating that the decision to terminate ferry operation may be taken by the ferryboat captains only after consulting with the appropriate town supervisor or his designee.

9. The evacuation of Long Beach Island by road is hindered by the density of traffic on the mainland responding to the evacuation order, and by the flooding of roads. The City of Long Beach believes that safety lies not in leaving the barrier island, but rather in taking refuge on the upper floors of the 40 to 50 high rise buildings in the City. City officials believe that these buildings could accommodate the entire population.

   However, these tall buildings could be subjected to buffeting by gale force winds and waves in a severe storm. There is a need to determine whether the buildings can tolerate these forces, particularly when carrying heavy loads at their upper levels. An engineering study of the buildings designated as refuges by city management should be undertaken immediately to see if it is possible to use this means of safeguarding the population in a storm.

10. Flooding of Montauk Highway (Route 27) at Napeague can cover several miles of roadway, and effectively isolate the east end of the Town of East Hampton. Local authorities are concerned that the closure of the highway deprives people of access to a hospital. The Town believes that the best solution is to set up a mobile hospital, having a range of capabilities yet to be determined, and to dispatch it to a suitable location east of Napeague when a storm warning is issued. The local fire departments believe that they would have little trouble handling any other storm-related difficulty.

4.5 REFERENCES

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U.S. Dept. of the Interior. undated. Undeveloped coastal barriers: report to Congress. U.S. Gov't. Print Off., Washington, D.C.

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Chapter 5....

Analysis of Federal and State Disaster Assistance Programs

5.0 INTRODUCTION

Information about the Federal Disaster Assistance Program, established by the Disaster Relief Act of 1974 (P.L. 93-288), can be found in a series of handbooks published by FEMA. The first in the series, entitled *Handbook for Applicants*, describes the policies and procedures used to request, obtain and administer Federal grants for public assistance. Others in the series provide information and guidelines on such topics as applicant eligibility, fire suppression, community disaster loans, environmental review, floodplain management, hazard mitigation, and contracting guidelines (FEMA, 1981a-d).

FEMA's *Program Guide for Disaster Response and Recovery* states that the President's Disaster Relief Program is designed to supplement the efforts and available resources of state and local governments and voluntary relief organizations. The President's declaration of a **major disaster** or an **emergency** authorizes Federal assistance under P.L. 93-288 and triggers other Federal disaster relief programs. The Federal response is coordinated by Disaster Response and Recovery office in FEMA. By Executive Order 12148, the President delegated the primary responsibility for administering the Act to the director of FEMA.

The flowchart in Fig. 5-1 details the procedure for the provision of Federal assistance following a Presidential declaration. FEMA coordinates the Federal response and provides assistance in accordance with the terms of the declaration.

The network of Federal, State and local officials and private relief agencies works out of a Disaster Assistance Center established by FEMA within the affected area. The center serves as an information center for individuals impacted by the disaster as well as a command center for coordinating the recovery effort.

A Presidential declaration of a major disaster makes available a broad range of assistance to individual disaster victims, including:

- temporary housing
- home repairs, mortgage and rental assistance
- unemployment assistance
- low interest loans to individuals, businesses and farmers for repair, rehabilitation or replacement of damaged real and personal property
- agricultural assistance
- distribution of food coupons

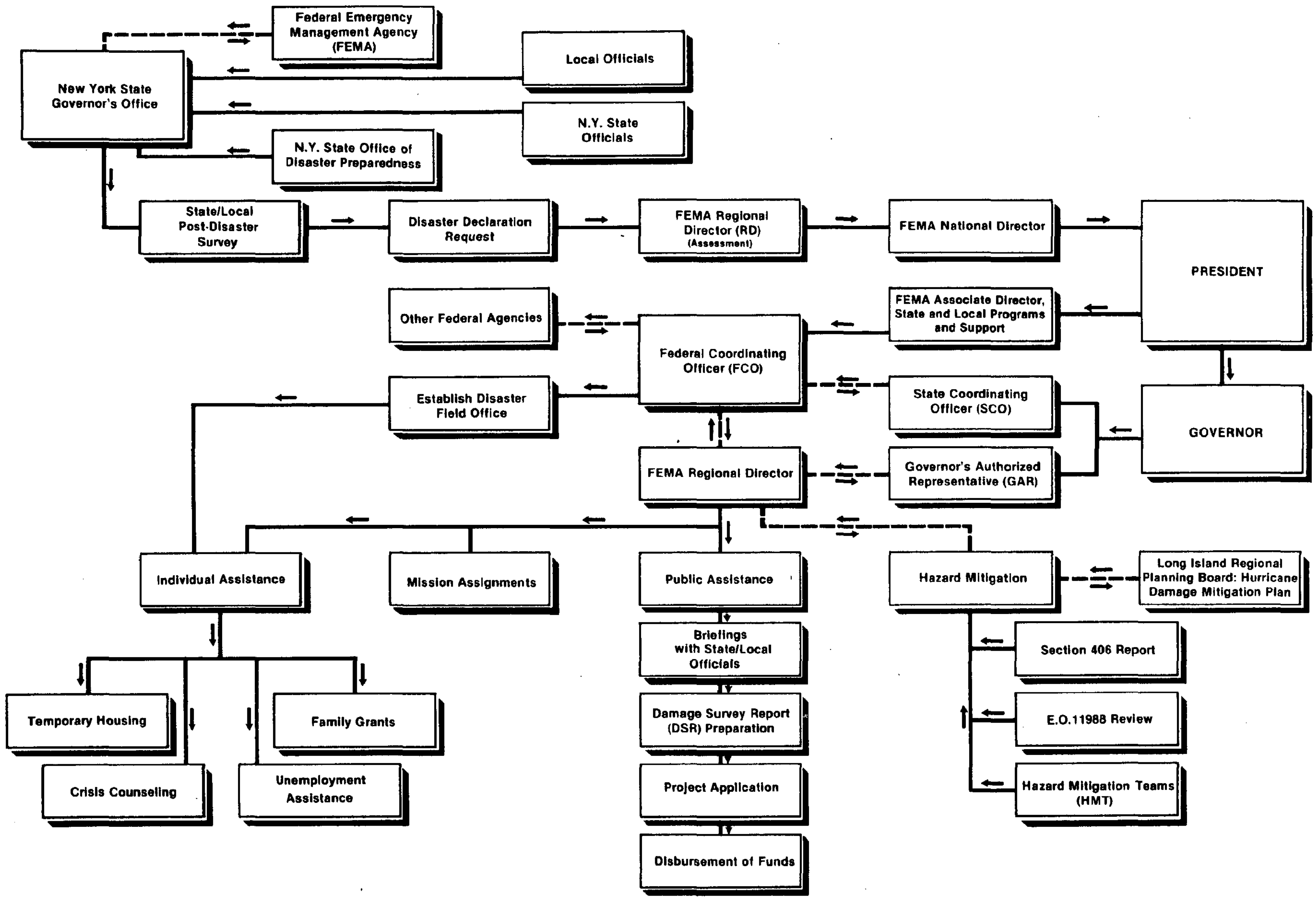

Figure 5-1
The President's Disaster Relief Program

Federal Emergency Management Agency (FEMA)
1. Monitor developing or potential disasters.

State/Local Post-Disaster Survey
1. Survey the affected areas (jointly w/FEMA) to determine the extent of public, private and agricultural damage.
2. Estimate the types and extent of Federal disaster assistance required.
3. Consult w/FEMA Regional Director on the eligibility for Federal disaster assistance.
4. Advise the FEMA Regional Office of the State's intention to request a major disaster declaration.

Disaster Declaration Request
1. The request is based on the finding that the disaster is of such severity that effective response is beyond the capabilities of the state and the affected local governments.
2. The request must include a certification of the reasonable expenditure of state and local funds, and an estimate of the extent and nature of Federal assistance required for each of the affected counties and the state.
3. Governor must direct execution of the state's emergency plan.

FEMA Regional Director (RD) (Assessment)
1. Evaluates damage, requirements for Federal assistance, makes recommendation to FEMA Director.

FEMA National Director
1. Recommends course of action to President.

PRESIDENT
1. Declares either a major disaster or emergency.

FEMA Associate Director, State and Local Programs and Support
1. Designates counties/municipalities eligible for Federal assistance
2. Appoints Federal Coordinating Officer (FCO)

Federal Coordinating Officer (FCO)
1. Initial appraisal of types of relief most urgently needed.
2. Coordinates all Federal disaster assistance programs and private relief organizations to ensure their maximum effectiveness, helps citizens and local officials obtain assistance.

Other Federal Agencies
1. FEMA coordinates Federal response, provides Federal assistance according to terms of declaration.

Establish Disaster Federal Field Office
1. Set up, within affected area, within 48 hours of the disaster declaration.
2. Staffed by FCO and Federal officials with disaster assistance responsibilities in the area.
3. Located in conjunction with Office of SCO.

GOVERNOR
1. Appoints State Coordinating Officer (SCO) and Authorized Representative (GAR)

State Coordinating Officer (SCO)
1. Serves as the primary point of contact between the FCO and state and local officials.
2. Sets up office in conjunction with FEMA Disaster Field Office.
3. Coordinates activities of state agencies, local governments, assistance from non-affected communities, and the private sector.

Governor's Authorized Representative (GAR)
1. Evaluates, recommends and relays local and state agency requests for assistance to the FEMA RD.
2. Prepares project applications for FEMA assistance, or review and approves those prepared by local agencies before forwarding them to FEMA for final review and approval.

FEMA Regional Director
1. Upon notification by President, activates Hazard Mitigation Team.
2. Responsible for FEMA financial assistance programs.

Briefings with State/Local Officials
1. Within a week of the disaster declaration, FEMA informs State/Local officials of the types of assistance available under the declaration, and the means by which funds are provided for eligible disaster assistance projects.

Damage Survey Report (DSR) Preparation
1. DSR's prepared by federal engineers to document disaster damage and to provide FEMA with a recommended scope of work and estimated costs in accordance with FEMA eligibility criteria.

Project Application
1. Submitted by eligible applicants through the state to the FEMA RD for approval, along with supporting DSR's.
2. Must be submitted within 90 days of Presidential major disaster declaration; within 20 days of Presidential emergency declaration (unless FEMA RD shortens or extends the periods).

Disbursement of Funds
1. Funds are obligated following the FEMA RD's approval.
2. Advances may be made any time after obligation of funds.

Mission Assignments for Federal Agencies
1. Delegated to various Federal agencies by FCO, requesting the provision of specific assistance and services which will then be refunded out of Federal disaster funds.

Hazard Mitigation
1. Submitted to FEMA RD, appropriate public agencies and the news media for implementation.
2. FEMA coordinates and monitors implementation.
3. Submitted to FCO for incorporation into Federal disaster assistance programs.
4. Submitted to state and local agencies through interagency team members.

Long Island Regional Planning Board: Hurricane Damage Mitigation Plan
1. Site specific mitigation recommendations.
2. Evaluation of mitigation alternatives.
3. Local assistance and input.
4. Local damage assessments, maps & studies, aerial photos, flood insurance information.
5. Development/redevelopment policies & guidelines.

Section 406 Report
1. Pursuant to Section 406 of the Disaster Relief Act, states are required to prepare long range hazard mitigation plans within 6 months of the signing of the federal/state agreement following the declaration of a disaster.

E.O.11988
1. Requires federal agencies to incorporate floodplain management practices into federally funded programs or facilities.

Hazard Mitigation Teams (HMT)
1. Within 15 days after the declaration, the HMT must submit a Hazard Mitigation Report that contains recommendations for implementing flood hazard mitigation measures in the recovery process. The recommendations are submitted to the FEMA RD and affected Federal agencies. The recommendations are non-binding.

- legal services
- emergency disaster loans
- consumer and crisis counseling
- Social Security and veterans assistance

A Presidential declaration of an emergency makes available a narrower range of assistance targeted directly to the stated emergency (FEMA, 1980).

The key to providing assistance to state and local governments is the *Damage Survey Report* (DSR), prepared by Federal engineers, which documents the damage to public facilities and provides FEMA with an estimate of the scope and cost of the work necessary to reconstruct the damaged facilities. The following types of projects could be eligible for funding:

- clearance of debris on public or private land or waters
- emergency protective measures
- repair or replacement of roads, streets and bridges
- repair or replacement of water control facilities, public buildings and utilities, recreational facilities and parks, and certain private non-profit facilities
- community loans to communities suffering substantial losses of tax revenue
- repairs and operating assistance to public elementary and secondary schools
- use of equipment supplies, facilities, personnel and other resources from various Federal agencies (FEMA, 1980).

A substantial amount of assistance is available, however, from the Federal Government without the need for a Presidential declaration of either a major disaster or an emergency. This aid includes the following:

- search and rescue operations by the U.S. Coast Guard
- flood protection from the U.S. Army Corps of Engineers
- fire suppression assistance in the form of grants, equipment, supplies and personnel
- vocational rehabilitation assistance through the U.S. Dept. of Education
- cost-sharing of emergency conservation measures and emergency loans for agriculture
- Small Business Administration disaster loans for homeowners and businesses
- repairs to federally aided roads and highways
- tax refunds for losses resulting from natural disasters.

Finally, private relief organizations, e.g., American National Red Cross, the Salvation Army, the Mennonite Disaster Service, and other charitable organizations provide essential assistance such as the distribution of food, medicine and supplies, the provision of emergency shelter, and the restoration of community services. (FEMA, 1980).

A major problem with past Federal disaster relief efforts has been that the provision of assistance to rebuild a community has typically not been tied to plans for redevelopment that incorporate floodplain management and hazard mitigation guidelines, which would act to guide development away from high hazard areas, and thus reduce future flood losses.

The Federal approach to hazard mitigation is embodied in section 406 of P.L. 93-288 and the procedures for flood hazard mitigation outlined in the FEMA manual entitled *Flood Hazard Mitigation, Handbook of Common Procedures–Interagency Regional Hazard Mitigation Teams* (FEMA, 1981e). Section 406 mandates that hazard mitigation be included in the Federal-State Disaster Assistance Agreement as a condition requiring state and local governments receiving Federal assistance to evaluate natural hazards and undertake appropriate mitigating actions. A long-range State Hazard Mitigation Plan must be submitted to FEMA's regional director by the state within 180 days after the Presidential declaration. The plan is based upon the recommendations from an Interagency Hazard Mitigation Team, site visits, analysis of damage survey reports, and state and local hazard mitigation plans and programs (McElyea, Brower and Godschalk, 1982).

5.1 SURVEY OF FEDERAL AND STATE DISASTER ASSISTANCE PROGRAMS

The information developed in this section is intended to be used both as a reference by public officials with disaster assistance responsibilities, and by interested citizens. It describes disaster assistance programs on the Federal level and operations and responsibilities of New York State agencies that can be extended and expanded to assist disaster recovery efforts.

The programs described herein do not represent a comprehensive listing of all Federal emergency-related assistance. Rather, an attempt has been made to highlight only those programs that relate in some way to long-term recovery and mitigation efforts, namely, those programs that provide assistance for mitigation measures, post-disaster repairs, reconstruction and redevelopment. Programs that provide immediate post-disaster emergency assistance or general individual and community assistance that is not necessarily emergency-related have not been included. Information on these programs can be obtained from the *Digest of Federal Disaster Assistance Programs* (FEMA, 1982).

5.1.1 Federal Disaster Assistance Programs

Tables 5-1 and 5-2 are two indexes that summarize the key parameters of the Federal assistance programs. An attempt has been made to distinguish long-term recovery programs from short-term emergency assistance. Table 5-1 describes the significant Federal disaster-related assistance programs that provide assistance that is targeted for long-term recovery and mitigation activities, including post-disaster repairs, reconstruction and redevelopment, floodplain and emergency management assistance, emergency loans for businesses and homeowners, and various other forms of disaster assistance. Most of these programs require a Presidential disaster declaration before they can be utilized in the community. Table 5-2 describes Federal assistance programs that, while they are not specifically intended to provide disaster relief funds for long-term recovery and mitigation activities, may nonetheless prove to be a significant source of assistance for many people following a disaster.

Tables 5-1 and 5-2 identify, for each program:

- the *Digest* page number
- the U.S. Office of Management and Budget (OMB) (1982) catalog identification number(s)
- the types of assistance
- the target(s) of the assistance
- whether or not a Presidential disaster declaration is required to release the assistance
- whether the assistance is emergency-related
- whether the aid is to be used prior to or following the disaster (or both).

The Federal aid programs listed in this section were identified by examining the *Digest of Federal Disaster Assistance Programs*, published in June 1982. The digest is the most current and comprehensive listing of available Federal programs, even those not specifically targeted toward the provision of disaster relief funds which can be used to provide pre- and post-disaster assistance.*

Once the significant assistance programs dealing with hurricane damage mitigation and long-term recovery assistance were identified, their program descriptions were obtained from the 1982 edition of OMB's Catalog of Federal Domestic Assistance, which is the most recent edition published.

5.1.2 New York State Disaster Assistance Programs

The mandate for New York State's Disaster Preparedness Program is Article 2-B of the State's Executive Law. The law establishes the N.Y. State Disaster Preparedness Commission (sec. 21), provides for a State declaration of a disaster or emergency (sec. 28), mandates the preparation of a State disaster preparedness plan and authorizes local plans (secs. 22, 23), and provides guidelines for post-disaster recovery planning and the use of local government resources in a disaster situation.

The New York State Disaster Preparedness Commission has general coordination and overview responsibility for the State's Disaster Preparedness Program. It is assisted by the Office of Disaster Preparedness, which carries out the day-to-day functions required by the programs. In addition, the office acts as the focal agency for hurricane-related disasters, which involves the suggestion of new or improved activities, and means and methods to improve state mitigation activities with respect to other levels of government and the private sector.

With respect to damage mitigation activities, the State has three major roles:

- It encourages and supports activities carried out by other organizations.
- It funds activities carried out by other organizations.
- It carries out activities directly as program functions of the State (N.Y. State Disaster Preparedness Commission, 1982).

In addition, every State agency is required to incorporate disaster mitigation considerations into their rules, programs, projects and activities.

* Personal communication, Mr. Jose Bravo, FEMA Region II, New York.

TABLE 5-1

Index of Federal Aid Programs Targeted to Mitigation and Recovery Activities

Program	FEMA** DFDAP Page No.	OMB*** CFDA No.	P	e	$	L	dp	g	I	NF	G	C	B	bd	ad	b/a
1. Emergency Conservation Program (ECP)	1-5	10.054		X	X		X					X				X
2. Agricultural Conservation Program (ACP)	1-1	10.063			X		X					X		X		
3. Emergency Feed Program	1-6	10.066		X	X		X					X			X	
4. Emergency Loans	1-7	10.404	X	X	X	X						X			X	
5. Federal Crop Insurance	1-3	10.450			X				X			X			X	
6. Beach Erosion Control Projects	10-4	12.101								X	X			X		
7. Flood Control Works and Federally Authorized Coastal Protection Works	5-3	12.102		X						X	X	X			X	
8. Flood Plain Management Services (FPMS)	5-8	12.104		X						X	X	X		X		
9. Protection of Essential Highways, Highway Bridge Approaches, and Public Works	5-11	12.105		X						X	X			X		
10. Flood Control Projects	5-2	12.106		X						X	X			X		
11. Snagging and Clearing for Flood Control	5-14	12.108		X						X	X			X		
12. Protection, Clearing and Straightening Channels	5-10	12.109		X						X	X			X		
13. Planning Assistance to States	5-1	12.110								X	X			X		
14. National Mapping, Geography and Surveys	9-8	15.803								X	X					X
15. Taxpayer Service	8-6	21.003	X	X						X		X			X	
16. Donation of Federal Surplus Personal Property	10-11	39.003								X	X	X			X	
17. Economic Injury Disaster Loans (EIDL)	2-3	59.002	X	X	X	X							X		X	
18. Physical Disaster Loans	8-5	59.008		X	X	X						X	X		X	
19. Flood Insurance	5-7, 5-9	83.100		X	X				X	X	X	X	X			X
20. Aquisition of Flood-Damaged Structures	10-1	83.502		X						X	X				X	
21. Emergency Management Assistance	9-3	83.503		X	X			X			X					X
22. State Disaster Preparedness Grants	9-7	83.505		X	X			X			X			X		
23. Earthquake and Hurricane Loss Study and Contingency Planning Grants	9-1	83.506		X	X			X			X			X		
24. Disaster Assistance	VAR₁*	83.516	X	X	X			X		X	X	X			X	
25. School Assistance in Federally Affected Areas—Construction	10-22	84.040	X		X			X			X				X	
26. School Assistance in Federally Affected Areas—Maintenance and Operation	10-23	84.041	X		X			X			X				X	
27. Flood Hazard Studies	5-5	—								X	X	X		X		
28. Flood Insurance Studies	5-6	—								X	X			X		

Symbol	Key
L	financial assistance in form of loans
g	financial assistance in form of grants
i	financial assistance in form of insurance
dp	financial assistance in form of direct payments
pd	aid to be used for mitigation and pre-disaster planning
ad	aid to be used following (after) disaster
b/a	aid to be used both before and after disaster
P	Presidential designation of disaster area required to release aid
$	financial assistance
NF	non-financial assistance
G	ais targeted to state and/or local governmental units

Symbol	Key
C	aid targeted to private citizens
B	aid targeted to businesses
e	assistance is emergency-related without requiring presidential declaration of disaster area

* VAR_1 1-13; 3-1, 2, 4, 7; 4-1; 6-1; 7-1, 2, 12; 8-1, 2, 3, 4, 7; 10-5, 14, 19, 20.

** FEMA DFDAP: The Federal Emergency Management Agency's *Digest of Federal Disaster Assistance Programs.*

*** OMB CFDA: The U.S. Office of management and Budget's *Catalog of Federal Domestic Assistance.*

TABLE 5-2

Index of Emergency Federal Aid Programs and Applicable Non-Disaster Related Assistance Programs

Program	FEMA** DFDAP Page No.	OMB*** CFDA No.	P	e	$	NF	L	dp	g	I	G	C	B	bd	ad	b/a
Dairy Indemnity Payments	1-4	10.053			X			X					X		X	
Soil and Water Loans	1-12	10.416			X	X	X					X	X			X
Alcohol and Tobacco Tax Claim Information	2-2	—		X		X							X		X	
Emergency Relief (for Federal-Aid Roads)	3-3	—	X	X	X			X			X				X	
Forecasts and Warnings	3-5	—		X		X					X	X	X	X		
National Oil and Hazardous Substances Pollution	3-6	—		X		X					X					X
Radiological Emergency Assitance	3-8	81.028		X		X					X	X	X			X
Fire Suppression and Emergency Rehabilitation of Indian Lands	4-2	—		X		X						X				X
Flood Fighting and Rescue Operations	5-4	12.103		X		X					X				X	
River and Flood Forecast and Warning Services	5-12	—		X		X					X	X	X	X		
Watershed Protection and Flood Prevention	5-15	10.904			X	X		X			X					X
Disease Control—Investigations, Surveillance and Technical Assitance	6-2	13.283				X					X	X				X
Plant and Animal Disease and Pest Control	6-3	10.025				X					X	X				X
Farm Labor Housing Loans and Grants	7-3	10.405			X		X		X		X	X				X
Housing Grants, Direct Payment/Loan and Guaranteed/Insured Loans	7-4	VAR$_1$*			X		X		X			X				X
Low to Moderate Income Housing Loans	7-5	14.410			X		X					X				X
Manufactured (Mobile) Home Loans Insurance-Financing Purchase of Mobile Homes as Principal Residences of Borrowers	7-6	14.110	X		X		X					X			X	
Mortgage Insurance	7-7	VAR$_2$*			X					X		X				X
Mortgage Insurance—Homes for Disaster Victims	7-9	14.119	X		X		X					X			X	
Rural Housing Site Loans	7-10	10.411			X		X				X	X				X
Rural Rental Housing Loans	7-11	10.415			X		X					X				X
Very Low-Income Housing Repair Loans and Grants	7-13	10.417			X				X			X				X
Assistance Payments—Maintenance Assistance	10-3	13.808			X				X			X				X
Community Facilities Loans	10-6	10.423			X		X				X	X				X
Community Planning and Development	10-7	VAR$_3$*			X		X		X		X	X				X
Community Relations Service	10-8	16.200				X					X	X				X
Comprehensive Employment and Training Programs	10-9	17.232			X				X		X					X
Cooperative Forestry Assistance	10-10	10.664			X				X		X					X
Grants-In-Aid for Railroad Safety—State Participation	10-13	20.303			X				X		X					X
Indian Assistance	10-15	VAR$_4$*			X	X	X		X			X				X
Motor Carrier Safety	10-16	20.217				X					X					X
Refugee Assistance—State Administered Programs	10-18	13.814			X				X		X					X
Resource Conservation and Development	10-21	10.901			X	X			X		X					X
State and Community Highway Safety	10-25	20.600			X				X		X					X
Victim Identification	10-26	16.303		X		X					X				X	
Water and Waste Disposal Systems for Rural Communities	10-27	10.418			X				X		X					X
Weatherization Assistance Program for Low-Income Persons	10-28	81.042			X				X		X					X

TABLE 5-2 (cont'd.)

Program	FEMA** DFDAP Page No.	OMB*** CFDA No.	P	e	$	NF	L	dp	g	i	G	C	B	bd	ad	b/a
Volunteer Organizations:																
American National Red Cross	11-1		X	X	X	X	X	X	X			X			X	
Mennonite Disaster Service	11-3			X		X						X			X	
The Salvation Army	11-4			X		X						X			X	

Footnotes: OMB CDFA Program No.'s

VAR$_1$*: Housing Assistance	VAR$_2$*: Mortgage Assistance		VAR$_3$*: Community Planning and Development	VAR$_4$*: Indian Assistance
14.103	14.135	14.137	14.218	15.103
14.105	14.108	14.124	14.219	15.108
14.141	14.112	14.125	14.221	15.113
14.142	14.115	14.126	14.222	15.114
14.146	14.116	14.127		15.123
14.147	14.117	14.128		15.124
14.149	14.118	14.129		15.130
14.151	14.120	14.130		15.141
14.156	14.121	14.132		15.142
14.157	14.122	14.133		15.143
14.158	14.123	14.134		
	14.138	14.154		

** **FEMA DFDAP:** The Federal Emergency Management Agency's *Digest of Federal Disaster Assistance Programs.*

*** **OMB CFDA:** The U.S. Office of Management and Budget's *Catalog of Federal Domestic Assistance.*

KEY: See Table 5-1.

With respect to recovery activities, the State Office of Disaster Preparedness assists in the development and review of local disaster planning efforts. The Disaster Preparedness Commission may appoint a temporary group of policy level personnel from various State agencies that provide technical assistance to recovery efforts required of local communities under Article 2-B.

With respect to direct State involvement in mitigation and recovery activities, the agencies' various programmatic responsibilities empower them to provide assistance to localities and citizens. In addition, they command a certain amount of regulatory control over local actions wherein the State can require the adoption of a number of disaster mitigation measures.

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The following State agencies assist and support local disaster mitigation and recovery, and have responsibilities pertaining to long-range recovery, repair, reconstruction and redevelopment.

- Dept. of Agriculture and Markets
- Dept. of Audit and Control
- Dept. of Banking
- Dept. of Commerce
- Dept. of Education
- Dept. of Environmental Conservation
- Dept. of Health
- Division of Housing and Community Renewal
- Office of Mental Health
- Division of Military and Naval Affairs, Office of Disaster Preparedness
- Public Service Commission
- Dept. of State
- Dept. of Social Services
- Dept. of Taxation and Finance
- Dept. of Transportation
- Urban Development Corporation

For a more complete description of State disaster response activities conducted by these agencies, see the New York State Disaster Preparedness Commission (1982).

5.2 DEVELOPMENT OF GENERIC ASSISTANCE NEEDS

In order to develop a framework within which to evaluate the coverage and adequacy of the identified assistance programs, a listing was drawn up identifying, in a general way, the types of assistance that would most likely be needed in the occurrence of a major flooding event. By evaluating the generic assistance needs against the available assistance programs, it should be possible to identify the assistance programs that will be most appropriate for use in a post-disaster situation on the south shore of Long Island.

5.2.1 Assistance Program Evaluations

Table 5-3 compares the Federal disaster assistance programs identified in Table 5-1 with the generic assistance needs identified by the LIRPB. An **x** in a program's column on the row of one of the assistance needs means that, according to the descriptions of that aid program's objectives and uses given in the OMB *Catalog of Federal Domestic Assistance,* the aid provided by that program should be able to help fulfill that specific assistance need. Since this evaluation is intended to be generic, and because aid amounts depend largely on the specific circumstances of the need, it is not possible to quantify the match-ups of aid and assistance needs now.

5.3 REFERENCES

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______. 1981e. Flood hazard mitigation: handbook of common procedures—interagency regional hazard mitigation teams. Report No. FEMA-14. Washington, D.C.

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McElyea, William D., D.J. Brower, and D.R. Godschalk. 1982. Before the storm: managing development to reduce hurricane damages. Center for Urban and Regional Studies. University of North Carolina at Chapel Hill. Chapel Hill, N.C.

New York State Disaster Preparedness Commission. 1982. New York State disaster preparedness plan (revised). Albany, N.Y.

U.S. Office of Management and Budget. 1982. Catalog of federal domestic assistance. U.S. Gov't. Print. Off., Washington, D.C.

TABLE 5-3

Federal Disaster Assistance Programs and Assistance Needs

Assistance Needs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
A. Repair, Restoration and/or Replacement of property/structures																												
1. Public acquisition of property/structures																				X								
2. R/R/R Industrial, Business, Residential																		X										
3. R/R/R Private/Non-profit																								X				
4. R/R/R Farm property/supplies			X	X																								
5. Housing Loans/Grants																		X										
6. Loan/Mortgage Adjustments				X																								
7. Replacement of supplies/equipment																X										X		
8. Refund of excise & other taxes																								X				
9. Insurance to cover losses					X														X									
10. R/R/R of public facilities																								X	X			
11. Unemployment assistance																								X				
12. Health care/disease control																												
13. Provision of Operating Expenses/Liability Coverage				X													X									X		
B. Environmental/Erosion Control																												
1. Water Conservation	X												X															
2. Pollution abatement/control		X											X															
3. Erosion control/conservation of farmland	X	X																										
4. R/R of dunes/beaches																												
5. R/R/R and construction of erosion/flood control works and projects						X	X			X	X																	
6. Wreckage/debris clearance																								X				
7. Channel clearance/maintenance												X																
8. Bank Protection								X																				
9. Floodplain management/regulations																				X								
C. Information/Study Needs																												
1. Emergency/disaster plans																					X	X	X					
2. Public information program															X							X						
3. Flood hazard studies								X																			X	X
4. Floodplain planning								X					X															
5. Vulnerability analysis								X															X					
6. Preparedness/response programs																					X	X	X					
7. Technical assistance								X						X	X												X	X
8. Legal assistance																								X				

Federal Disaster Assistance Programs (columns 1–28)

R/R/R = repair, restoration and/or replacement

Note: The columns Nos. 1-28 under *Federal Disaster Assistance Programs* refer to the numbered programs listed in Table 5-

Glossary

GLOSSARY OF ACRONYMS AND SELECTED TERMS

CAPE	- Community Assistance and Program Evaluation
CBRA	- Coastal Barrier Resources Act
CDP	- Census Designated Places
CEHA	- Coastal Erosion Hazard Areas Act
CMP	- Coastal Management Programs
COE	- U.S. Army Corps of Engineers
CPI	- Central Pressure Index
DSR	- Damage Survey Report
ECL	- Environmental Conservation Law
FEMA	- Federal Emergency Management Agency
FINS	- Fire Island National Seashore
FIRM	- Flood Insurance Rate Map
HMT	- Interagency Regional Hazard Mitigation Team
LIRPB	- Long Island Regional Planning Board
LISPRC	- Long Island State Park and Recreation Commission
NFIP	- National Flood Insurance Program
NGVD	- National Geodetic Vertical Datum
NYSDEC	- New York State Department of Environmental Conservation
NYSDOS	- New York State Department of State
OBRA	- Omnibus Budget Reconciliation Act
OMB	- U.S. Office of Management and Budget
SCDEP	- Suffolk County Department of Emergency Preparedness
STP.	- Sewage Treatment Plant
USGS	- U.S. Geological Survey

A *Zone* – a special hazard zone located within the 100-year floodplain, extending from the boundaries of the **V** zone to the limits of the 100-year flood hazard area.

Base Flood Elevation – height of the 100-year stillwater storm surge, including wave effects, relative to sea level. Typically, elevations are highest at the open shoreline and decrease landward.

B *Zone* – located between the limits of the **A** zone and the limits of the 500-year floodplain, including areas protected from the 100-year flood by control structures; also, areas subject to 100-year flooding where depths are less than 1 ft; and also, areas subject to 100-year flooding from sources with drainage areas less than 1 mi^2.

Central Pressure Index – The estimated minimum barometric pressure in the eye (approximate center) of a particular hurricane. The CPI is considered the most stable index to intensity of hurricane wind velocities in the periphery of the storm; the highest wind speeds are associated with storms having the lowest CPI.

Cyclone – an atmospheric closed-circulation rotating counterclockwise in the Northern Hemisphere.

Depth-Limited Waves – breaking height equal to 0.78 times the stillwater depth; wave crest is 70% of the total wave height above stillwater level.

Energy Dissipation – reduction of wave height due to presence of obstructions including sand dunes, buildings and vegetation.

Fetch – the horizontal distance (in the direction of the wind) over which a wind generates seas or creates a wind setup.

Flood Boundaries – determined by 100-year flood, i.e., the *flood that has a 1% chance of being equalled or exceeded each year and is expected to be exceeded on the average during any 100-year period;* delineated by **A** and **V** Zones.

Flood Insurance Zones – subdivisions of velocity zones (e.g., A4, V4, V7, etc.) based on flood hazard factors, which correlate flood information with insurance rate tables.

Hurricane – a warm-core tropical cyclone in which the maximum sustained surface wind (1 minute mean) is greater than or equal to 64 knots (73.6 mph).

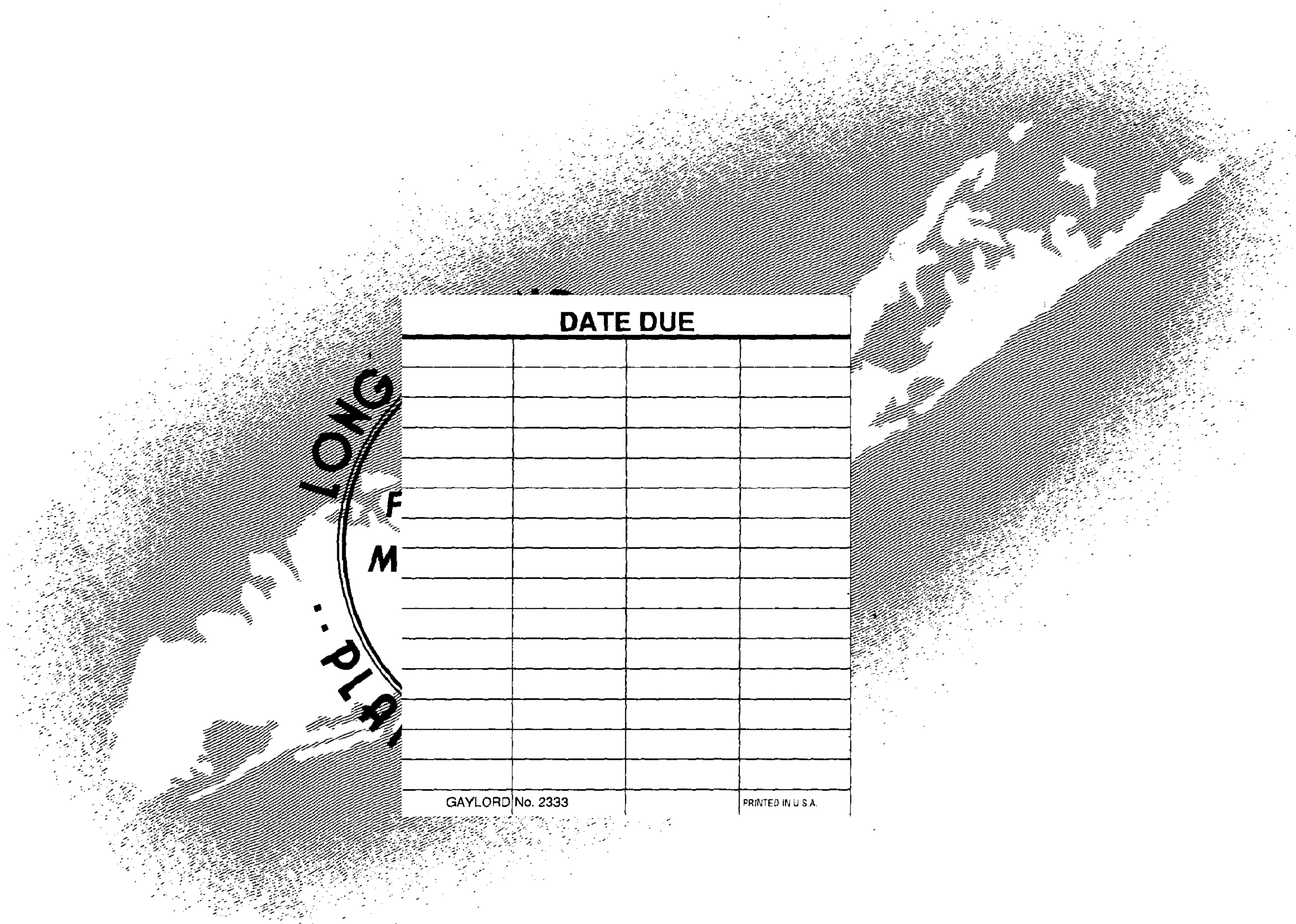
National Geodetic Vertical Datum – formerly called Sea Level Datum of 1929. A geodetic datum derived from general adjustment of the first order level nets of both the United States and Canada. In the adjustment, sea levels from selected tide stations in both counties were held as fixed. The year indicates the time of the last general adjustment. This datum should not be confused with mean sea level.

Tropical Storm – a warm-core tropical cyclone in which the maximum sustained surface wind (1 minute mean) ranges from 34 to 63 knots (39-72.5 mph).

Velocity Zones – **V** Zone high hazard area identified by the potential occurrence of 3 ft breaking waves, extends from shoreline landward to the **A** zone.

Wave Setup – Super-elevation of the water surface over normal surge elevation due to onshore mass transport of the water by wave action alone.

Wind Setup – The vertical rise in the stillwater level on the leeward side of a body of water caused by wind stresses on the surface of the water.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